

# **EXHIBIT 8**

UNITED STATES DISTRICT COURT  
DISTRICT OF MINNESOTA

3M COMPANY and 3M INNOVATIVE  
PROPERTIES COMPANY,

Plaintiffs,

vs.

MOLDEX-METRIC, INC.

Defendant.

Court File No.: 12-cv-611-JNE-FLN

**DECLARATION OF KEVIN D.  
CONNEELY IN SUPPORT OF  
DEFENDANT'S MOTION FOR  
SUMMARY JUDGMENT**

I, Kevin D. Conneely, declare as follows:

1. I am an attorney admitted to practice in the District of Minnesota and am one of the attorneys representing Defendant Moldex-Metric, Inc., in this matter.
2. Attached as Exhibit A is a true and correct copy of United States Patent No. 6,070,693, one of the two asserted patents in this suit.
3. Attached as Exhibit B is a true and correct copy of a publication entitled "Empirical evaluation using impulse noise of the level-dependency of various passive earplug designs," authored by Berger and Hamery (one of the named inventors on the asserted patent in this action).
4. Attached as Exhibit C is a true and correct copy of 3M marketing literature on 3M's "Combat Arms Earplugs."
5. Attached as Exhibit D is a true and correct copy of a French Patent Publication No. 2 676 642 ("FR'642") for an "Improved Hearing Protection Device."

6. Attached as Exhibit E is a true and correct copy of cited portions of the file history for United States Patent No. 5,936,208, application serial number 08/994,015.

7. Attached as Exhibit F is a true and correct copy of Defendant Moldex-Metric, Inc.'s Objections and Responses to Plaintiffs' First Set of Interrogatories dated June 18, 2012, and served by Moldex on counsel for 3M in this action.

8. Attached as Exhibit G is a true and correct copy of an internal Moldex product design document produced in this action by Defendant with the production number MM00014037. This document is designated as "Highly Confidential Technical Information" under the Protective Order and is being FILED UNDER SEAL.

9. Attached as Exhibit H is a true and correct copy of an internal Moldex product design document produced in this action by Defendant with the production number MM00014038. This document is designated as "Highly Confidential Technical Information" under the Protective Order and is being FILED UNDER SEAL.

10. Attached as Exhibit I is a true and correct copy of an internal Moldex product design document produced in this action by Defendant with the production number MM00014039. This document is designated as "Highly Confidential Technical Information" under the Protective Order and is being FILED UNDER SEAL.

11. Attached as Exhibit J is a photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013739.

12. Attached as Exhibit K is a photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013760.

13. Attached as Exhibit L is a photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013784.

14. Attached as Exhibit M is a photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013794.

15. Attached as Exhibit N is photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013827.

16. Attached as Exhibit O is a photograph of Moldex's accused products, produced in this action by Defendant with the production number MM00013889.

17. Attached as Exhibit P is a true and correct copy of United States Patent No. 3,565,069.

18. Attached as Exhibit Q is a true and correct copy of a publication entitled "Nonlinear Hearing Protection Devices," co-authored by the named inventor on the asserted patent.

19. Attached as Exhibit R is a true and correct copy of United States Patent No. 2,717,596.

20. Attached as Exhibit S is a photograph of a bisected Moldex product, produced in this action by Defendant with the production number MM00013905.

21. Attached as Exhibit T is a photograph of a bisected Moldex product, produced in this action by Defendant with the production number MM00014051.

22. Attached as Exhibit U is a photograph of a bisected Moldex product, produced in this action by Defendant with the production number MM00014052.

DATED: January 18, 2013

BY

s/Kevin D. Conneely

Kevin D. Conneely

# EXHIBIT A



US006070693A

**United States Patent**[19] **Hamery**

[11] Patent Number: **6,070,693**  
 [45] Date of Patent: **Jun. 6, 2000**

**[54] HEARING PROTECTOR AGAINST LOUD NOISE**

[75] Inventor: Pascal Hamery, Mulhouse, France

[73] Assignee: Institut Franco-Allemand de Recherches de Saint-Louis, Saint-Louis, France

[21] Appl. No.: 09/233,192

[22] Filed: Jan. 20, 1999

**Related U.S. Application Data**

[62] Division of application No. 08/994,015, Dec. 18, 1997, Pat. No. 5,936,208.

**[30] Foreign Application Priority Data**

Sep. 18, 1997 [FR] France ..... 97.11623

[51] Int. Cl.<sup>7</sup> ..... A61B 7/02

[52] U.S. Cl. ..... 181/135

[58] Field of Search ..... 181/130, 135; 128/864, 867; 2/209

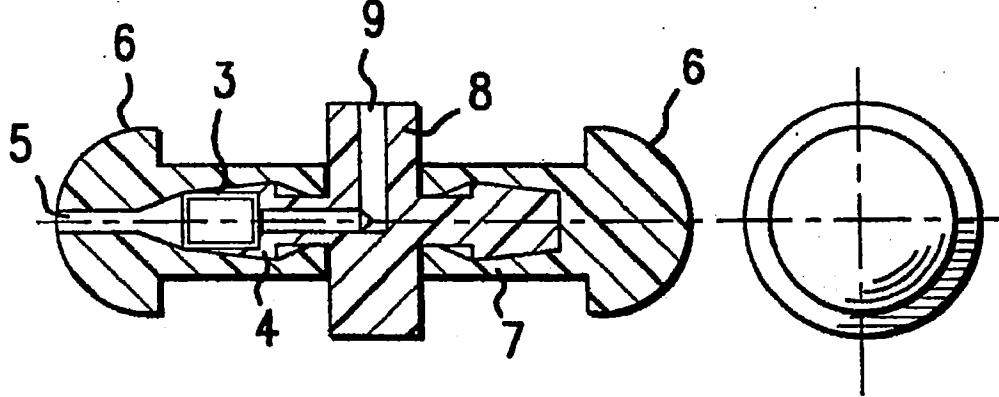
**[56] References Cited****U.S. PATENT DOCUMENTS**

|           |         |                             |
|-----------|---------|-----------------------------|
| 4,587,965 | 5/1986  | De Boer et al.              |
| 4,852,683 | 8/1989  | Killion                     |
| 5,113,967 | 5/1992  | Killion et al.              |
| 5,824,968 | 10/1998 | Packard et al. .... 181/131 |

*Primary Examiner—Khanh Dang  
 Attorney, Agent, or Firm—Oliff & Berridge, PLC*

**[57] ABSTRACT**

The invention relates to a hearing protector for attenuating, selectively or not, noises that can have an intensity of up to 190 dB, designed to be inserted in sealing fashion into the auditory canal. The hearing protector includes a flexible cylindrical body that has a ferrule at each end. At least one of the two ferrules has a channel that runs from one end of the ferrule to the center of the cylindrical body and contains an acoustic filter. When the two ferrules each contain an acoustic filter, the filters may or may not be identical.

**17 Claims, 3 Drawing Sheets**

U.S. Patent

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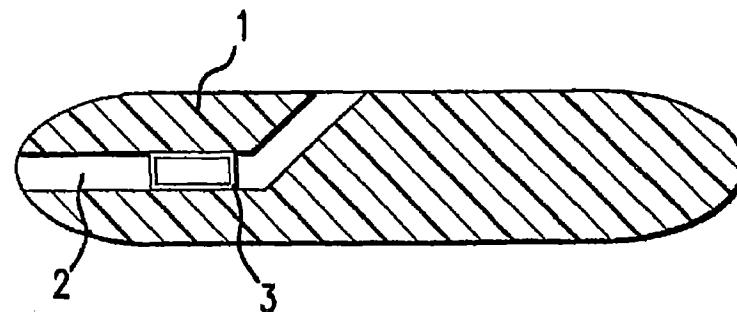


FIG.1

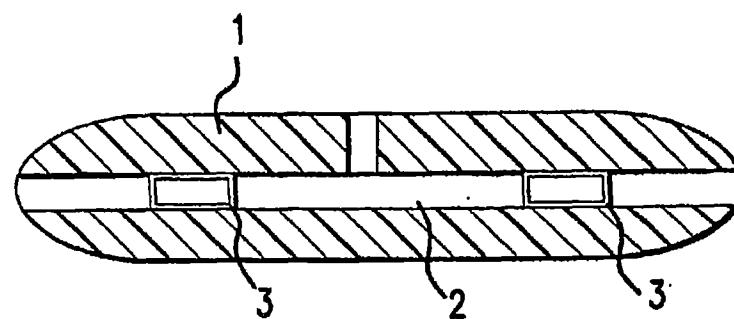


FIG.2

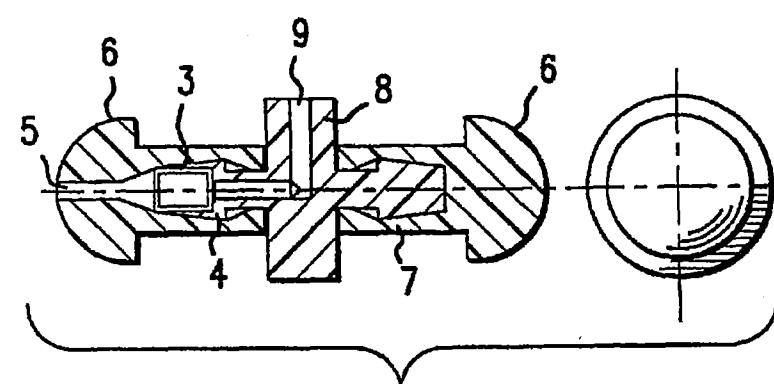


FIG.3

U.S. Patent

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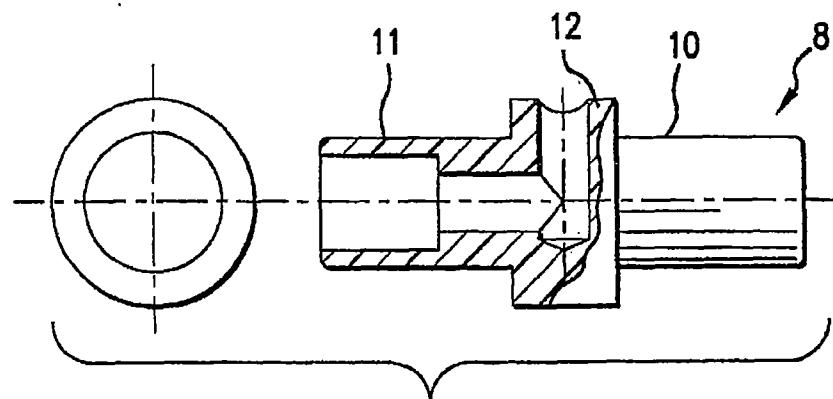


FIG. 4a

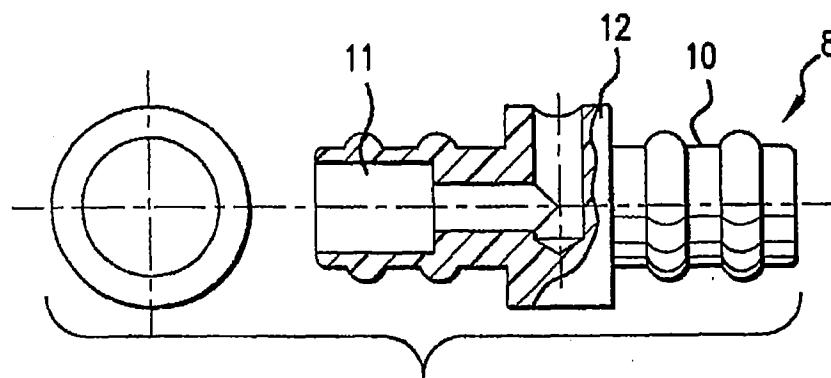


FIG. 4b

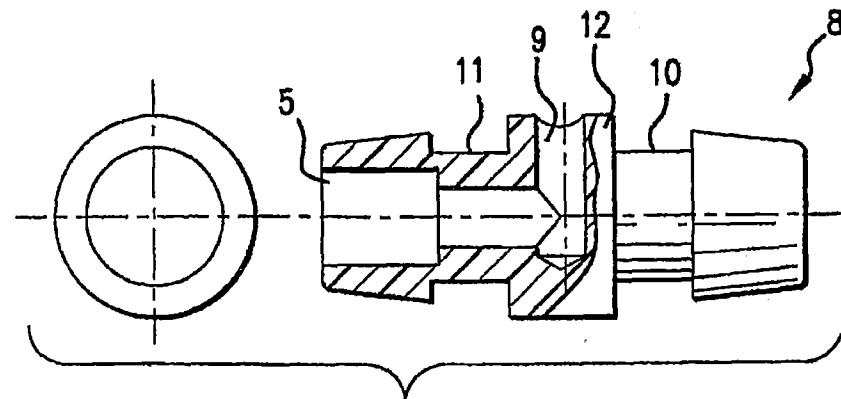


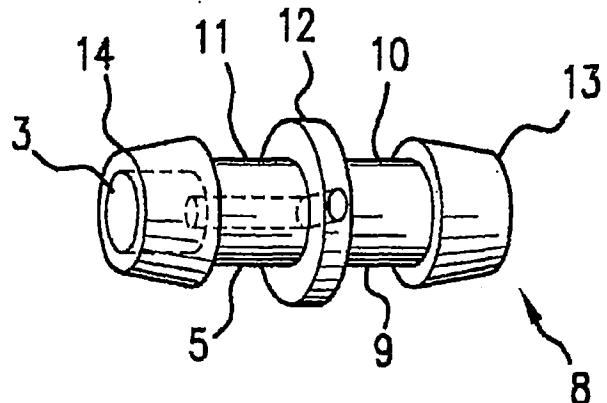
FIG. 4c

U.S. Patent

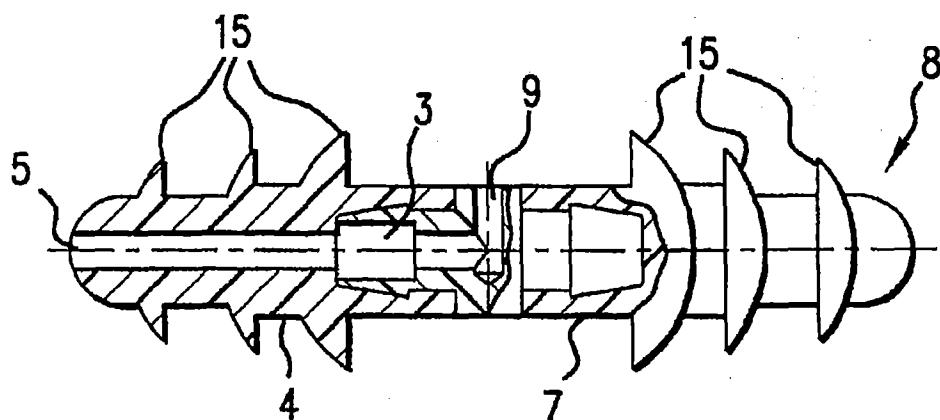
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**6,070,693**



**FIG. 5**



**FIG. 6**

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## HEARING PROTECTOR AGAINST LOUD NOISE

This is a Division of Application Ser. No. 08/994,015 filed Dec. 18, 1997, now U.S. Pat. No. 5,936,208. The entire disclosure of the prior application is hereby incorporated by reference herein in its entirety.

### BACKGROUND OF THE INVENTION

#### 1. Field of Invention

The invention relates to hearing protectors, and in particular, the invention relates to a hearing protector to protect against high, continuous or impulsive, noises. The hearing protector can function either in a selective attenuation mode or a maximum attenuation mode.

#### 2. Description of Related Art

In the selective attenuation mode, sound attenuation is low for a specific range of frequencies and increases for sounds with frequencies above those in the specified range. Selective attenuation is especially effective for the loudest noises. A sample application of a hearing protector operating in the selective attenuation mode is the intelligible speech transmission in a noisy environment caused by impulsive noises, such as gunshots, for example. In this case, the frequency range in which the attenuation is low is between 100 Hz to 1000 Hz. In the maximum attenuation mode, the hearing protector stops all sounds throughout the frequency range, regardless of their intensity.

French Patent Publication No. 2 676 642, filed in the name of the Applicant, discloses a hearing protector that is not cumbersome and contacts the auditory canal. The protector comprises an elongate flexible body containing selective attenuation means, maximum attenuation means, and a manually controlled plug that makes it possible to choose the attenuation functional mode to be either selective or maximum. However, this device requires careful handling by the user who wants to block the auditory canal himself. This manipulation can be done incorrectly, resulting in inefficient blockage in the selective or maximum attenuation modes.

### SUMMARY OF THE INVENTION

The goal of the present invention is to provide a reliable hearing protector that does not suffer from the disadvantage of user adjustment and permits two configurations for noise attenuation that have different characteristics.

Another goal of the present invention is to provide a reliable hearing protector capable of selectively or automatically attenuating noises having intensities up to 190 dB. The hearing protector is intended to be sealingly inserted into the auditory canal of the user. The hearing protector includes a flexible cylindrical body having a ferrule at each end, with at least one of the ferrules having a channel that runs from one end of the ferrule to the center of the body and contains an acoustic filter.

The hearing protector has two ends, both of which can be inserted into the auditory canal and is referred to as a "double-ended" device. This contrasts with the well-known hearing protector that typically has one end that can be inserted into the auditory canal, while the other end allows the hearing protector to be gripped so the user can position it in the auditory canal. The present invention has two ends, that may or may not be identical, either of which can be inserted into the auditory canal, thus making it possible to choose between two operating modes of attenuation that may or may not be identical.

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The device is useful in the fact that it possesses, in the same hearing protector, two configurations that can have different attenuation characteristics, both obtained by simply reversing the direction of the hearing protector, or ear plug, that is inserted into the auditory canal.

In a preferred embodiment, the two ferrules are separate parts linked by an internal connector. The internal connector may be a single cylinder pierced by a channel containing an acoustic filter, the cylinder forming a right angle that terminates at a first end of the channel and a second end at the center of the connector.

The internal connector may also be a single cylinder having a channel that terminates at three locations, such as at the center of the connector or at each end of the connector, with the parts of the channel terminating at the ends containing an acoustic filter that may or may not be identical.

The internal connector may also be composed of three cylindrical parts. The central part may have a channel at its center with a diameter slightly greater than that of the other two parts. The other two parts have a diameter that is essentially equal to or slightly larger than that of the channel. At least one of the two parts is pierced by a channel at its center which contains an acoustic filter and communicates with the channel in the central part. When the two parts each contain an acoustic filter, the filters may or may not be identical.

In an alternate embodiment, the internal connector may have serrations, or ridges, to hold the ferrules in place while in the auditory canal.

In yet another embodiment, the hearing protector may have tapered ends.

Preferably, each ferrule of the hearing protector is provided with an essentially hemispherical face of which the narrower side is intended to be inserted first into the auditory canal.

Advantageously, the body of the hearing protector may be provided with flexible annular fins having a diameter that increases from the inside to the outside of the auditory canal in order to wedgingly secure it in the auditory canal.

The hearing protector makes it possible to perform non-linear sound filtration by choosing the correct acoustic filter.

### BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in conjunction with the following drawings in which like reference numerals designate like elements and wherein:

FIG. 1 is a longitudinal view, in partial section, of a "double-ended" hearing protector according to a preferred embodiment of the present invention;

FIG. 2 is a longitudinal section view of a "double-ended" hearing protector according to a second embodiment of the present invention;

FIG. 3 is a longitudinal section view of a "double-ended" hearing protector according to a third embodiment of the present invention;

Figs. 4a-4c are longitudinal views, in partial section, of different configurations of the internal connector that join the two ends of the hearing protector according to the present invention;

FIG. 5 is a perspective view of an internal connector for the two ends of the hearing protector according to an embodiment of the present invention;

FIG. 6 is a longitudinal view, in partial section, of a hearing protector according to a fourth embodiment of the present invention.

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**DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

FIG. 1 is a longitudinal view, in partial section, of the hearing protector according to one preferred embodiment of the present invention. The hearing protector includes a body 1 that is molded to fit in the auditory canal of the user. The body 1 is pierced by a channel 2 that runs from an end of the body 1 and terminates in the center of the body 1. The channel 2 contains an acoustic filter 3 that allows for example the selective and nonlinear filtration of sound. The other end of the body 1 is not perforated and allows maximum attenuation, regardless of the frequency and amplitude of the sound. Ideally, the body 1 has a length between 2 cm and 4 cm and is composed of a flexible material.

FIG. 2 is a longitudinal section view of the hearing protector according to a second embodiment of the present invention. The hearing protector includes a body 1 pierced by a channel 2 that terminates at each end of the body 1, as well as the center of body 1. The channel 2 also contains an acoustic filter 3 at each end. The filters may or may not be identical.

Referring to a third embodiment illustrated in FIG. 3, the hearing protector includes two cylindrical hollow ferrules 4 and 7 and an internal connector 8. The ferrules 4 and 7 are separate pieces that fit into one another and are joined by the internal connector 8 to keep the ferrules 4 and 7 together. Each ferrule 4 and 7 is provided with a substantially hemispherical face 6. The narrower portion of the face 6 is designed to be inserted first into the auditory canal. The substantially hemispherical face 6 ensures tightness between the hearing protector and the auditory canal. As illustrated in FIG. 3, at least one of the two ferrules, in this case, ferrule 4, is pierced by a channel 5 at its center. One of the two ends of the internal connector 8 that contains an acoustic filter 3 is inserted into at least one of the two ferrules 4 and 7. The acoustic filter 3 permits the selective non-linear filtration of sounds. The second ferrule, in this case, ferrule 7, need not be perforated and will allow maximum attenuation regardless of the frequency and amplitude of the sound. The internal connector 8 is pierced by a second channel 9 that connects at a first end with the first channel 5, which contains an acoustic filter 3, allowing for the use of the acoustic filter 3, and at a second end with the center of the connector 8. The second channel 9 is formed at a right angle to the channel 5.

Alternatively, in another embodiment, the internal connector 8 may also have a channel that extends in three locations, the center of the internal connector 8, as well as at each end of the internal connector 8. The portion of the channel that terminates at each end contains an acoustic filter 3 that may or may not be identical.

As shown in FIG. 4a, the internal connector 8 may include a single cylinder consisting of three cylindrical parts 10, 11, and 12. The central part 12 is pierced by a channel 9 at its center and has a diameter that is slightly larger than that of the other two parts 10 and 11. The two parts 10 and 11 have a diameter that is essentially equal to, but slightly larger than that of channel 5 in order to hold the assembly together. At least one of the two parts 10 and 11 is formed with channel 5, which contains an acoustic filter 3 and communicates with channel 9 in the central part 12, as shown in FIG. 5.

The internal connector 8 may have serrations, or ridges, as shown in FIGS. 4b and 6, or the internal connector 8 may have tapered ends 13 and 14, as shown in FIGS. 4c and 5. In the case when the internal connector 8 is in three parts, the

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two parts 10 and 11 will have the serrations, ridges, or tapered ends 13 and 14.

One of the two ferrules has a perforation that, when joined to connector 8, is aligned with that of the central end of channel 9 located in part 12.

FIG. 6 is a longitudinal view, in partial section, of the hearing protector according to a fourth embodiment of the present invention. The hearing protector is provided with flexible annular fins 15 on the ferrules 4 and 7 to wedge the hearing protector against the walls of the auditory canal. The fins 15 may have a diameter that increases from the inside to the outside of the auditory canal.

The hearing protector, according to the present invention, is especially useful for individuals who are exposed to very loud engine and weapon noises, such as the crews of airplanes or military vehicles on exercises, for example. The hearing protector, according to the present invention, can also be used effectively by other personnel exposed to high-intensity noises in their working environments, such as construction sites and quarries for example.

While this invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth herein are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A hearing protector for selectively or automatically reducing noises having intensities up to 190 dB, the hearing protector being intended to be sealingly inserted into an auditory canal of a user, the hearing protector comprising:

a cylindrical body having a center, a first end and a second end;

a channel extending from said first and second ends to said center of said cylindrical body; and

said channel containing a first acoustic filter and a second acoustic filter, each of said first and second filters being in communication with one of said first and second ends.

2. The hearing protector according to claim 1, wherein said first and second acoustic filters are identical.

3. The hearing protector according to claim 1, wherein said first and second acoustic filters are not identical.

4. The hearing protector according to claim 1, further having a ferrule at each of said first and second ends wherein said ferrules are separate and said cylindrical body forms an internal connector linking said ferrules.

5. The hearing protector according to claim 4, wherein said internal connector is a single cylinder, said channel forming a right angle and having a first end of said channel containing said first acoustic filter and terminating at at least one of said ferrules and a second end of said channel terminating in said center of said internal connector.

6. The hearing protector according to claim 4, wherein said channel in said internal connector terminates at said center of said internal connector and at said first end and said second end of said internal connector, said first end containing said first acoustic filter and said second end containing said second acoustic filter.

7. The hearing protector according to claim 6, wherein said first acoustic filter is identical to said second acoustic filter.

8. The hearing protector according to claim 6, wherein said first acoustic filter is not identical to said second acoustic filter.

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9. The hearing protector according to claim 4, wherein said internal connector includes a central cylindrical part having a central diameter, a first cylindrical part having a first diameter and a second cylindrical part having a second diameter, said central diameter being larger than said first diameter and said second diameter, said first diameter and said second diameter being larger than said channel, said first cylindrical part containing said first acoustic filter and said second cylindrical part contains said second acoustic filter.

10. The hearing protector according to claim 9, wherein said first acoustic filter and said second acoustic filter are identical.

11. The hearing protector according to claim 9, wherein said first acoustic filter and said second acoustic filter are not identical.

12. The hearing protector according to claim 4, wherein said internal connector has serrations for securing said ferrules to said internal connector.

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13. The hearing protector according to claim 4, wherein said internal connector has ridges for securing said ferrules to said internal connector.

14. The hearing protector according to claim 4, wherein said internal connector has tapered ends.

15. The hearing protector according to claim 1, wherein said ferrules each have an essentially hemispherical face having a narrow side, said narrow sides being designed to be inserted into the auditory canal of the user first.

16. The hearing protector of claim 1, wherein said cylindrical body is provided with annular fins, said fins having a diameter that increases from said first and second ends of said cylindrical body toward said center of said cylindrical body, the hearing protector being wedgingly securable within the auditory canal of the user.

17. The hearing protector according to claim 1, wherein said acoustic filters permit non-linear filtration of sound.

\* \* \* \* \*

# EXHIBIT B



Sfa



ena



coustics'08  
Paris

June 29-July 4, 2008

[www.acoustics08-paris.org](http://www.acoustics08-paris.org)

## Empirical evaluation using impulse noise of the level-dependency of various passive earplug designs

E. H Berger<sup>a</sup> and P. Hamery<sup>b</sup>

<sup>a</sup>E-A-R / Aearo Technologies, 7911 Zionsville Rd., Indianapolis, IN 46268-1657, USA

<sup>b</sup>French German Institut of Saint Louis (ISL), 5 rue du Général Cassagnou, 68301  
Saint-Louis, France  
[eberger@compuserve.com](mailto:eberger@compuserve.com)

**CASE 0:12-cv-00611-JNE-FLN Document 36-2 Filed 01/18/13 Page 3 of 7****Acoustics 08 Parts**

An objective in the development of hearing protection devices (HPDs) has been the design of a passive earplug that provides modest or no attenuation at low sound levels, with greater protection at high sound levels. This raises the issue of not only how to construct such a device, but also how to evaluate it. There is the related question of whether conventional HPDs are actually level independent. Passive level dependency is typically accomplished via an orifice that causes sound transmission to decrease as input level increases. We utilized an impulsive noise source (explosives) with peak levels from 110 to 190 dB SPL to measure the insertion loss of a variety of commercially available and developmental earplugs. The tests were conducted at frontal incidence over a reflecting plane outdoors using the Institute of Saint-Louis acoustical test fixture specifically constructed for HPD attenuation measurements. Conventional foam and premolded earplugs exhibited attenuation that was essentially constant with level, whereas the best of the level-dependent designs provided attenuation that increased by about 25 dB over the 80-dB range of test impulse levels. This latter design has been successfully utilized since 2000 in the Combat Arms® Plug widely fielded in the U. S. Military.

## **1 Introduction**

It is commonly observed that the correct and consistent use of hearing protection devices (HPDs) with adequate noise reduction can prevent the occurrence of virtually all noise-induced hearing loss. However, an obvious problem can occur in the presence of an impulsive noise source for which the hearer has no warning and thus has not donned hearing protection. A useful improvement, especially in military operations, is an HPD that provides sufficient protection from the unexpected blasts, yet can be worn at all times when potential auditory danger is present without impeding acoustic perception, commonly called situational awareness in military parlance. It is possible to design an electronic product with such features, essentially a hearing aid at low levels with compression of higher level sounds, altogether another matter to accomplish this in a passive design, perhaps with moving parts, but no energy input besides that provided by the incoming sound or blast wave.

Since at least the 1960s the concept of a level-dependent (sometimes called "nonlinear") orifice in an earplug or earmuff has been explored.<sup>1,2</sup> One of the early researchers of such ideas, Clay Allen, developed the concept into a level-dependent earplug design, further examined by Forrest,<sup>3</sup> and marketed as the Gunfender, by Racial Safety Ltd. Additional passive designs have been introduced over the years including the well-known Lee-Sonic Ear Valv (which became the North Sonic Ear Valv® in various versions) and the Aural Technology Protectear™ more recently known as the Hocks Noise Braker. In the 1990s work began and was reported by the Institut of Saint Louis (ISL) on nonlinear orifices that led to an improved design embodied in the Combat Arms Earplug and other versions, as described more fully later in the report.

The Ear Valv design has employed over the years various types of valves, more recently diaphragms, that are intended to both move and close in response to high-level sound, thus providing substantially augmented protection. Although these designs do appear to provide a measure of level dependency, no data on the existing designs has been forthcoming that would suggest that the valve actually moves sufficiently to close down. The Protectear/Noise Braker is a constricted channel through an orifice which purports to utilize the "accelerated resonance decay principle" so that no sounds over 80 dB are allowed to pass through the filter.<sup>4</sup> Such extravagant claims have never been properly documented and are at odds with the accepted theoretical understanding of level-dependency caused by nonlinearity in small orifices<sup>5,6</sup>

Despite high interest in passive amplitude-sensitive earplugs and strong claims made by some manufacturers regarding their performance, sparse data are available in the literature. This is probably due in part to the difficulty of measuring the performance of these products. An early study using cadavers as acoustic test fixtures for objective measurements demonstrated level dependency for the Gunfender and Lee-Sonic products.<sup>7</sup> Several well-controlled studies using human subjects exposed to weapon's fire and explosives have also been reported in the literature and demonstrate the protectiveness of perforated, presumably level-dependent earplugs and earmuffs for such noises.<sup>8-10</sup> However, we are unaware of any studies that have comprehensively examined the measured attenuation of a wide variety of purportedly level dependent HPDs over a range of sound levels from threshold to 190 dB SPL; hence the need for this study.

## **2 Passive level dependency – theoretical background**

Level dependency in passive hearing protectors may cause either an increase or decrease in attenuation with increasing sound level. Clearly the former is preferred, but the latter may be observed when for example a blast is sufficiently intense that the induced motion in the earplug or earmuff causes it to momentarily or permanently lose its acoustic seal. On the other hand, increasing attenuation, a positive feature in HPD design, has been theoretically and empirically demonstrated with narrow sharp-edged orifices as noted above.

The attenuation of the orifice can be thought of as a resistive element that is the ratio of the acoustic pressure in the orifice to the particle velocity through it. At low sound levels, streamlined airflow predominates and the pressure is therefore linearly related to the particle velocity. However, at sufficiently high levels turbulence occurs as vortexes are generated at the exit of the orifice, and the pressure then becomes proportional to the square of the particle velocity and the resistance increases. A detailed analysis can be found in [6].

A key point is that in such designs the level-dependency arises due to an orifice, which at levels below where its amplitude sensitivity becomes apparent, is effectively an acoustic leak that degrades attenuation of the basic passive device, were the hole not present. Thus, the level-dependent increase in attenuation does not and cannot increase the attenuation over that of the basic passive HPD with the hole sealed shut, rather it serves to decrease the

loss in attenuation caused by the orifice at low sound levels. Level dependency only becomes apparent as the sound level increases above a transition level at which the turbulence appears.

The most effective passive orifice designs to date demonstrate level dependency first occurring around 110 to 115 dB SPL.<sup>6</sup> Once level dependency is initiated, the maximum theoretical rate of increase is 0.5-dB-per-decibel increase in sound level above the critical transition level.

### 3 Procedures

In order to benchmark the attenuation of the devices in this study, they were evaluated by the first author using the standardized method of real-ear attenuation at threshold. Since such measurements are conducted at relatively low sound levels within 40 to 50 dB of the hearing threshold levels of normal-hearing subjects, these data represent the low-sound level attenuation of the HPDs in this study, at levels well below the transition region.<sup>11</sup>

Procedures that have typically been utilized for the measurement of level-dependent attenuation include microphone-in-real ear (MIRE) measurements and the use of acoustical test fixtures (ATFs). Both are objective procedures that can be implemented at sound levels well above threshold, and hence can be used to explore attenuation at and above the transition sound pressure level. The ATF procedure for the studies reported herein was implemented by the second author.<sup>11</sup>

Both the REAT and ATF procedure are described in greater detail below.

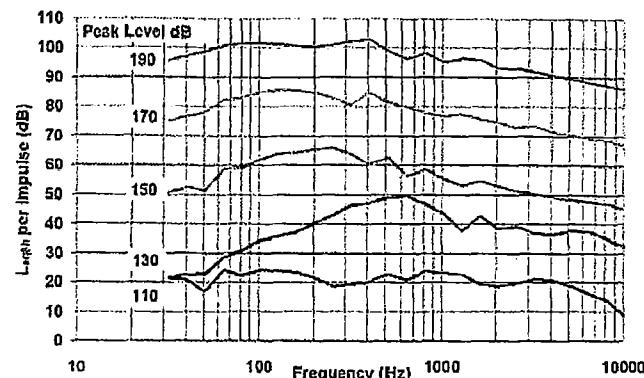
#### 3.1 Real-ear attenuation at threshold

REAT was measured in the E•A•RCAL<sup>SM</sup> facility of Aearo Technologies according to ANSI S12.6-1997 (R2002).<sup>12</sup> Depending on the device, the subject count and measurements per subject was either 10 x 3 or 5 x 2, vs. the 20 x 2 that is called for in S12.6. Another variance from the standard was the exact method of fitting the HPD, although the procedure utilized closely mimicked Method A of the standard. The goal was to make sure the devices were well fitted so that the leakage path controlling the attenuation and also potentially behaving in a level-dependent manner was the intentional one, normally an orifice, and not a leak around the earplug itself.

#### 3.2 Acoustical test fixture measurements

The ATF that was utilized was designed and constructed by ISL.<sup>13</sup> Tests were conducted outdoors above a reflecting plane using impulse noises created at the lowest sound level by gunfire and at increasing levels by a detonator, primer, or C4 explosives. The test noise spectra are shown in Fig. 1. Sounds were incident on the ATF at frontal incidence (grazing incidence to the distal end of the earplugs).

Sound levels were simultaneously measured outside the ear of the test fixture and at its "eardrum." Those data provided noise reduction values that were then converted to



insertion loss by use of the transfer function of the open ear (TFOE) of the ATF. Details of the ISL test procedures can be found in [6].

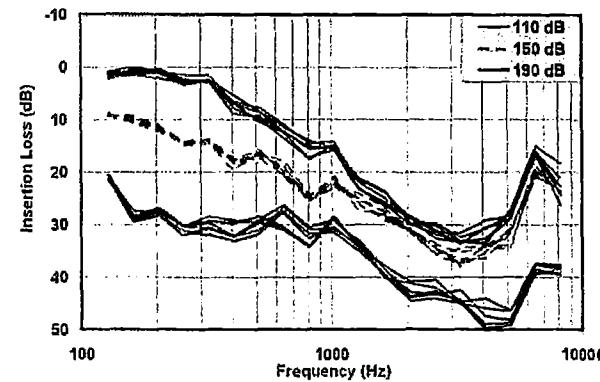


Fig. 1 - Spectra of the impulses used for testing.  
Fig. 2 - Repeatability of IL measurements on one sample Combat Arms Earplug measured 8 times over 2-yr. time frame.

An indication of the repeatability of the measured data can be gleaned from Fig. 2. These data represent 8 measurements on four samples of the Combat Arms Earplug over a two-year period. These are the raw ATF insertion-loss values without the corrections described in the next paragraph. The range in values over the 8 measurements is 2 – 3 dB at each frequency regardless of impulse level.

The ATF utilized had inherent insertion loss values of at least 65 dB from 80 Hz to 10 kHz, which exceeds the bone-and tissue-conduction (BC) limits to the human skull. This assures that its measurements were not contaminated by its own "BC" pathways. On the other hand this means that larger values of insertion loss can be measured on the ATF than can actually be realized on human heads. Therefore, the data were computationally corrected by presuming a BC pathway in parallel with the sound-conduction pathway through the HPD. The BC values are based upon the data from Berger et al.<sup>14</sup> The values were also adjusted by the magnitude of the occlusion effect as observed in REAT testing in order to make the ATF-measured data correspond as closely as possible with REAT values. This was a 2-dB correction at 125 Hz, decreasing to 0 dB at 250 Hz.

In addition to the impulse noise measurements, steady-state measurements were also conducted using the ISL ATF in an 85-dBA reverberant quasi-diffuse sound field in order to characterize the performance of the level-dependent devices at sound levels below the transition region.

### 3.3 Product test samples

The earplugs evaluated in this study are shown in Fig. 3 and listed, along with a description of their level-dependent elements, in Table 1. The level-dependent data described herein for the dual-ended Combat Arms earplug have been found to also describe the simpler single-ended version also containing the ISL filter in the stem of a premolded UltraFit® earplug as well as to the most recent single-ended design, also with an ISL filter that uses a selector dial.

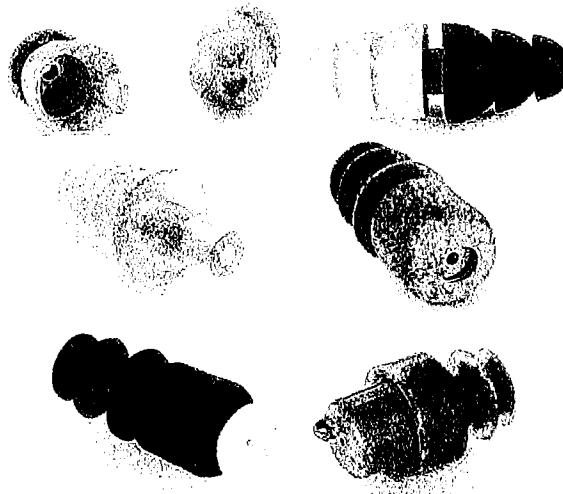


Figure 3 – Earplugs tested in this study as described in Table 1. Gunfender (back and front view), Combat Arms, Noise Braker, Ear Valvs, Sound Baffler, and Quiet Please (left to right, top to bottom).

| Earplug                         | Description of level-dependent element            |
|---------------------------------|---------------------------------------------------|
| Amplivox Gunfender              | metal disc with 0.6-mm ID hole                    |
| E·A·R® Combat Arms Earplug      | ISL filter with 0.3-mm ID hole at each end        |
| Hicks Noise Braker® earplugs    | tapered 5.5-mm tube; ID varies from 0.3 to 0.9 mm |
| North Sonic Ear Valvs® earplugs | rubber diaphragm between metal plates             |
| Silencio® Super Sound Baffler   | rubber diaphragm between metal and plastic plate  |
| Tico Quiet Please               | sintered metal and fabric filters                 |

Table 1 – Earplugs tested in this study

## 4 Results

The plug that we have studied most thoroughly is the Combat Arms plug with the ISL filter. That filter, consisting of a small plastic canister with 0.3-mm inside diameter (ID) holes at each end has been imbedded in the

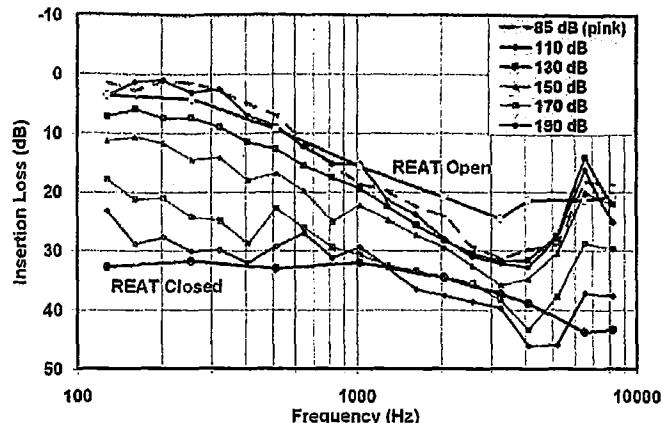


Fig. 4 – IL for the Combat Arms Earplug over an 80-dB range in impulse sound levels and for steady 85-dB pink noise as compared to REAT measurements for the open and closed orifices.

stem of various versions of the UltraFit® earplugs, both dual-ended (as shown in Fig. 3) and single-ended designs. We begin by reporting data graphically in Fig. 4, for the dual-ended version of that product as illustrated in Fig. 3.

The dashed line shows the IL (corrected for BC and occlusion effect) in 85-dBA pink noise as compared to the IL for five levels of impulses from 110 to 190 dB peak SPL. Note the close comparison of the IL in pink noise and for the 110-dB impulse (both measured in the same ATF). This indicates the same amount of attenuation regardless of steady or impulsive sounds as long as the input levels are the same. The IL then grows substantially as levels increase above 110 dB.

REAT curves (human-subject data) are superimposed in Fig. 4. Ideally the REAT-open curve (meaning that the level-dependent orifice is open and exposed to the sound field) would match the pink-noise curve. The agreement is within a few dB except from 2 – 4 kHz where the ATF values are higher by as much as 7 dB. This may be due to the different sound fields and to the ATF not exactly modeling real-ear performance.

The REAT-closed values are measured with a sealed orifice. They represent the maximum IL possible for these tests with this particular plug style. Thus, the level-dependent attenuation with the orifice open would not be expected to exceed those values since the best the level-dependent orifice can do is behave as though it were closed. The data in Fig. 4 confirm this supposition except from 2 – 4 kHz where the level-dependent performance exceeds the expected values, likely due to the same ATF- and sound-field related issues described in the prior paragraph.

The data for the Gunfender are shown in Fig. 5. This is a “classic” level-dependent orifice design and as Allen and Berger<sup>5</sup> reported previously it is indeed level dependent. As in Fig. 4 the pink-noise and 110-dB impulse curves closely align and this time the REAT-open values are in reasonable agreement too.

A final example is shown in Fig. 6 for the Noise Braker earplug. This too is an orifice design, but this time a tapered tube. In the high frequencies the agreement between the pink-noise and 110-dB impulse curves is off by about 4 dB at 4 kHz, but is in closer agreement at 8 kHz.

There is also an unexplained divergence between the pink-noise and REAT values at a number of frequencies. Though the Noise Braker does show level-dependent behavior, there is no indication that it conforms to the product claims of sudden increase in attenuation for input levels above 80 dB.

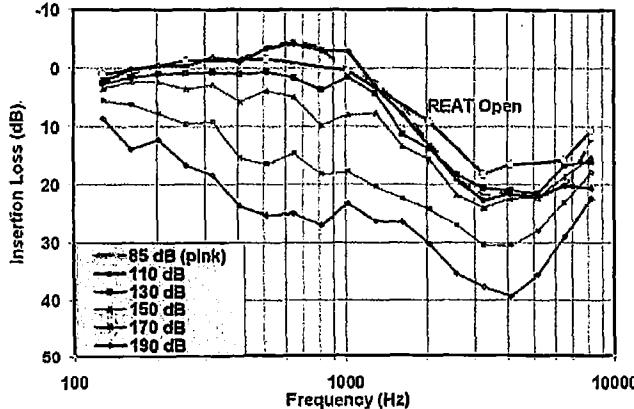


Fig. 5 – IL for the Gunfender earplug over an 80-dB range in impulse sound levels and for steady 85-dB pink noise as compared to REAT measurements for the open orifice.

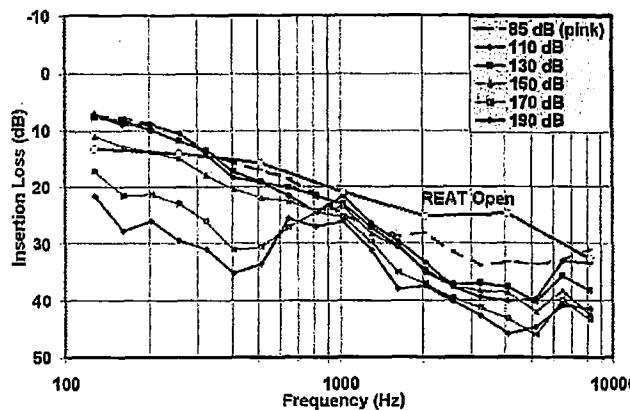


Fig. 6 - IL for the Noise Braker earplug over an 80-dB range in impulse sound levels and for steady 85-dB pink noise as compared to REAT measurements for the open orifice.

Though space does not permit presenting the data, similar analyses were completed for the other products listed in Table 1. The results for all of the earplugs are summarized in a different format in Fig. 7 where the computed overall noise reduction of the impulses is presented as a function of the impulse level. These values are computed like the Noise Reduction Rating (NRR)<sup>15</sup> used in the U. S. with a standard deviation of 4.0 dB at all frequencies, representative of the variability found in REAT evaluations of these types of plugs.

The data in Fig. 7 indicate that all of these purportedly level-dependent earplugs do provide a measure of level dependency. Though theory suggests that a rate of increase in attenuation of 0.5-dB-per-dB increase in sound level is achievable, the best in practice is 0.25-dB-per-dB as can be noted by comparison to the dashed curve in Fig. 7. Some, like the Noise Braker, show only a slow growth at first, and then increase closer to the 0.25-dB rate at the sound levels increase. Others like the Gunfender provide a uniform

increase over the range, but start out with so little attenuation initially at the low frequencies (see Fig. 5) that the overall noise reduction is less than or equal to 0 dB until the impulses exceed 150 dB. The Combat Arms Plug provides a uniform increase over the entire range with level-dependency first occurring at or above 110 dB.

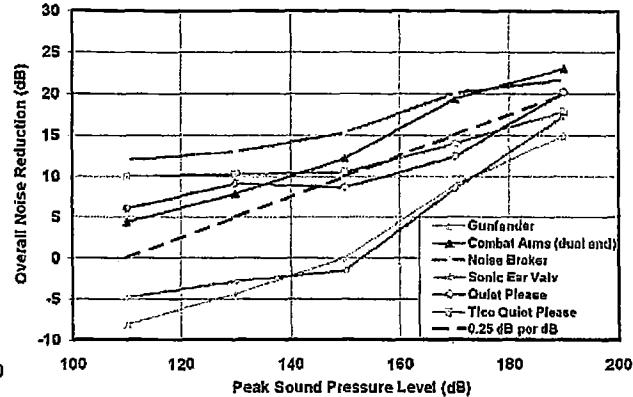


Fig. 7 – Overall noise reduction (computed like the Noise Reduction Rating, but using an assumed standard deviation of 4.0 dB at all frequencies) as a function of peak SPL, for six level-dependent earplugs as compared to a uniform increase of 0.25 dB per dB increase in SPL.

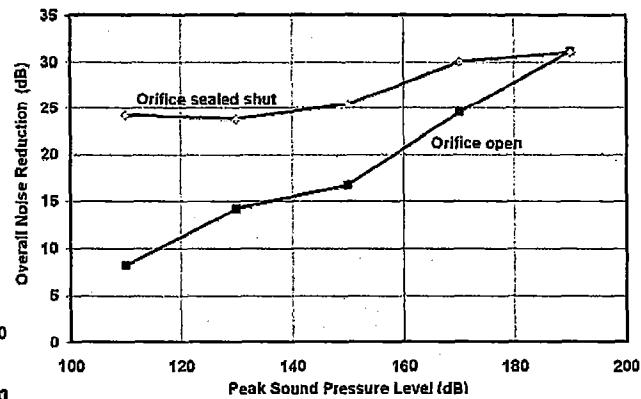


Fig. 8 – Overall noise reduction as a function of peak SPL for an orifice-type level-dependent earplug with the orifice open or sealed shut.

As a test of the measurement system and to research the possibility that all types of earplugs would behave nonlinearly and afford level-dependent protection at very high sound levels, a number of tests were conducted on plugs that would be expected to provide level-independent attenuation. One such test is presented in Fig. 8 for the Combat Arms Earplug open and sealed shut. Though there is some evidence of level dependency in the sealed orifice it is substantially less than with the open orifice. The agreement between the attenuation for the open and sealed orifices at the highest test levels, 190 dB, can also be seen in Fig. 4, as was previously discussed.

Additional tests of a conventional premolded and foam earplug were also conducted. Though the data are not reported herein, those devices were found to provide insertion loss that was substantially independent of incident sound level with slight or marginal changes (about 5 dB) in attenuation seen at some frequencies over a wide range of

*Acoustics 08 Paris*  
sound levels. This type of performance would be expected for an imperforate hearing protector unless the sound levels or blast exposures were sufficient to dislodge the seal of the product.

## 5 Conclusion

A variety of purportedly level-dependent as well as conventional intentionally level-independent earplugs were evaluated. Procedures included subjective REAT to establish the attenuation of the devices at low sound levels and in real ears, and an objective ATF procedure accomplished with both moderately high-level (85-dB) pink noise as well as noise impulses from 110 to 190 dB SPL. All of the devices that were designed to be level dependent included an orifice or valve assembly, and all of them indeed exhibited level-dependent behavior of varying magnitudes. The most effective, the Combat Arms Earplug, provided an increase in attenuation of 19 dB overall reduction (25 dB in the peak levels) over the 80-dB range of sound levels that were tested. Such designs have been shown in human-subject studies to improve situational awareness over standard earplugs, and yet provide sufficient protection from weapons fire in most situations.<sup>8,10</sup>

By contrast representative premolded and foam earplugs devoid of orifices were also evaluated and found to provide attenuation that was substantially independent of sound level. This was also illustrated on a level-dependent earplug that was evaluated with its orifice open and functioning vs. sealed shut.

Though level-dependent behavior was observed, it was not of the dramatic type that has been claimed to occur for certain passive valve- or orifice-based earplugs in which attenuation would supposedly change dramatically from none to substantial as one crossed over a threshold value well below 100 dB. In fact, even the best of the level-dependent designs only begins to provide amplitude sensitivity as sound levels equal or exceed 110 dB. Thus these types of products are only suited for protection from impulsive noises since when steady sound levels reach 110 dB the amounts of attenuation provided by such earplugs is insufficient for hearing protection.

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Jack Vernon.

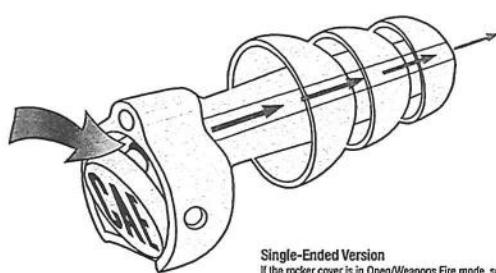
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# **EXHIBIT C**



3M Occupational Health & Environmental Safety Division  
Military Combat Safety Gear

### Explanation of the Hear-Through™ Protection Utilized by the Combat Arms™ Earplugs

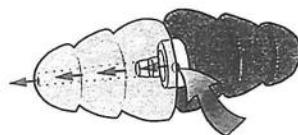


#### Single-Ended Version

If the rocker cover is in Open/Weapons Fire mode, sound travels into the earplug and down the sound channel to the special filter. The filter allows lower-level sounds to pass with limited interruption but high-level impulsive noises are restricted. The more intense the impulse, the more it is limited.

#### Dual-Ended Version

Sound travels into the opening at the middle of the earplug and down the sound channel to the special filter. The filter allows lower-level sounds to pass with limited interruption but high-level impulsive noises are restricted. The more intense the impulse, the more it is limited.



#### Single-Ended Combat Arms™

| Product Code | NSN #            | Description                     | Minimum Purchase Info | Case Quantity | Case Dimensions L x W x H (in.) | Case Wt. (lbs.) | NRR (Open) | NRR (Closed) |
|--------------|------------------|---------------------------------|-----------------------|---------------|---------------------------------|-----------------|------------|--------------|
| 370-1030     | 6515-01-576-0537 | Single-Ended CAE (green)        | 1 Case                | 50 pair       | 7.725 x 6.50 x 2.5              | 1.29            | 7 dB       | 23 dB        |
| 370-1031     | 6515-01-576-0561 | Single-Ended CAE (yellow/green) | 1 Case                | 50 pair       | 7.725 x 6.50 x 2.5              | 1.29            | 7 dB       | 23 dB        |
| 370-1032     | 6515-01-576-0563 | Single-Ended CAE (purple)       | 1 Case                | 50 pair       | 7.725 x 6.50 x 2.5              | 1.41            | 7 dB       | 23 dB        |

#### ATTENUATION DATA (ANSI S3.19-1974)

##### Single-Ended Combat Arms - Open/Weapons Fire mode

| Frequency (Hz)         | 125 | 250 | 500  | 1000 | 2000 | 3150 | 4000 | 5000 | 6300 | 8000 | 10000 | NRR | CSA CLASS |
|------------------------|-----|-----|------|------|------|------|------|------|------|------|-------|-----|-----------|
| Mean Attenuation dB    | 4.1 | 4.5 | 11.0 | 17   | 24.5 | 29.8 | 25.8 | 18.7 | 26.5 |      |       | 7   | C         |
| Standard Deviations dB | 2.7 | 2.8 | 5.0  | 3.3  | 3.3  | 3.7  | 3.3  | 3.6  | 3.2  |      |       |     |           |

##### Single-Ended Combat Arms - Closed/Constant Protection mode

| Frequency (Hz)         | 125  | 250  | 500  | 1000 | 2000 | 3150 | 4000 | 5000 | 6300 | 8000 | 10000 | NRR | CSA CLASS |
|------------------------|------|------|------|------|------|------|------|------|------|------|-------|-----|-----------|
| Mean Attenuation dB    | 30.3 | 28.7 | 22.2 | 31.9 | 31.7 | 26.0 | 25.1 | 31.9 | 27.0 |      |       | 23  | BL        |
| Standard Deviations dB | 3.4  | 3.0  | 3.4  | 3.8  | 3.0  | 4.4  | 4.8  | 5.4  | 4.3  |      |       |     |           |

#### Dual-Ended Combat Arms™

| Product Code | NSN #            | Description                        | Minimum Purchase Info | Case Quantity   | Case Dimensions L x W x H (in.) | Case Wt. (lbs.) | NRR (Green End) | NRR (Yellow End) |
|--------------|------------------|------------------------------------|-----------------------|-----------------|---------------------------------|-----------------|-----------------|------------------|
| 370-1000     | 6515-01-460-2710 | Dark CAE Dual-End CAE Blister Pack | 1 Case                | 50 pair         | 6.75 x 6.50 x 5.25              | 0.45            | 22 dB           | 0 dB             |
| 370-1011     | Not Applicable   | CAE Blister Pack                   | 1 Case                | 10 Blister pkts | 8.25 x 6.00 x 8.00              | 1.58            | 22 dB           | 0 dB             |

#### ATTENUATION DATA (ANSI S3.19-1974)

##### Dual-Ended Combat Arms - Weapons Fire mode (yellow end)

| Frequency (Hz)         | 125 | 250 | 500 | 1000 | 2000 | 3150 | 4000 | 5000 | 6300 | 8000 | 10000 | NRR | CSA CLASS |
|------------------------|-----|-----|-----|------|------|------|------|------|------|------|-------|-----|-----------|
| Mean Attenuation dB    | 4.7 | 4.2 | 6.0 | 9.5  | 16.7 | 18.5 | 16.3 | 16.7 | 17.2 |      |       | 0   | None      |
| Standard Deviations dB | 4.0 | 4.3 | 5.0 | 6.7  | 4.8  | 5.7  | 5.8  | 6.1  | 6.8  |      |       |     |           |

##### Dual-Ended Combat Arms - Constant Protection mode (green end)

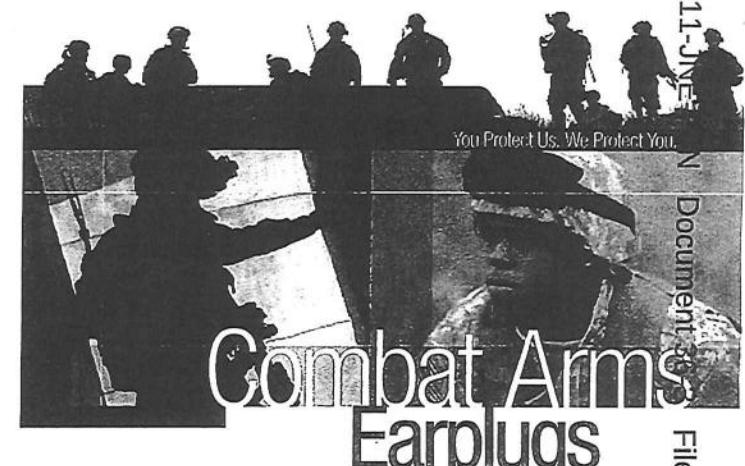
| Frequency (Hz)         | 125  | 250  | 500  | 1000 | 2000 | 3150 | 4000 | 5000 | 6300 | 8000 | 10000 | NRR | CSA CLASS |
|------------------------|------|------|------|------|------|------|------|------|------|------|-------|-----|-----------|
| Mean Attenuation dB    | 32.7 | 31.8 | 33.0 | 32.0 | 34.6 | 37.3 | 38.9 | 43.8 | 43.3 |      |       | 22  | AL        |
| Standard Deviations dB | 5.9  | 6.1  | 6.5  | 5.5  | 4.7  | 5.3  | 6.1  | 6.7  | 6.6  |      |       |     |           |



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#### Patented Dual-Protection Design

3M™ Combat Arms™ Earplugs (CAE) meet the demanding hearing protection needs of the armed forces. In the Open/Weapons Fire mode, CAE allows greater situational awareness than a common foam earplug yet protects against dangerous peak levels with a filter element that reacts instantaneously to provide increased protection. In the Closed/Constant Protection mode, CAE protects against high-level steady noises like those in tracked vehicles and air transport. The closed version of the Combat Arms utilizes a new finger-touch rocker cover that can be operated while the earplug is in the ear.

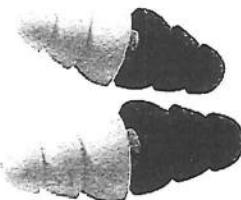
## Designed for Combat

**Designed to Meet the Unique Demands of the Armed Forces**  
 The level-dependent technology used in the earplug (and the earplug itself) has been tested on human subjects and found to be protective at 190 dB SPL for at least 100 exposures (sufficient to cover the loudest weapons in the military inventory, including shoulder-fired rockets). The earplug sizing options for the single-ended Combat Arms™ accommodate 98% of the adult population's earcanals for proper fit. There is a 100% product testing protocol for impedance characteristics. Combat Arms earplugs do not require batteries and include convenient retention cords. The single-sided versions feature an in-ear switching mechanism for the user to toggle between impulse noise and steady state noise hazards (23 dB NRR in the Constant Protection mode).

### Dual-Ended Combat Arms™ Earplugs

- Original patented dual-protection design
- Designed to allow wearer to hear low-level sounds
- High-impulse noise attenuated quickly
- Premolded triple-flange-design fits most earcanals
- Comfortable and reusable
- No batteries required

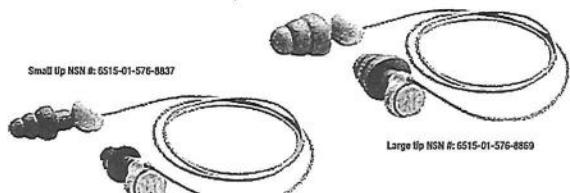
Uncorded dual-ended version.  
 Optional cord available.  
 NSN #: 6515-01-466-2710



### Single-Ended Combat Arms™ Earplugs

- Deployed in recent Rapid Fielding Initiatives
- Designed to allow wearer to hear low-level sounds
- High-impulse noise attenuated quickly
- Three sizes of triple-flange-design fits most earcanals
- Comfortable and reusable
- No batteries required

Small Up NSN #: 6515-01-576-8837



Large Up NSN #: 6515-01-576-8869

Regular Up NSN #: 6515-01-576-8861



### Patented Dual-Protection Design

**Open/Weapons Fire Mode:** This earplug's patented design gives wearers a better ability to hear low-level sounds critical to mission safety – conversation, footsteps, rifle bolts. When needed, the plug's filter provides attenuation of high level noises like weapons fire and explosions.

**Closed/Constant Protection Mode:** for attenuation of constant noise (aircraft, armored vehicles, etc.) without hear-through.



## FAQ

### FREQUENTLY ASKED QUESTIONS ABOUT THE (single-ended) COMBAT ARMS™ EARPLUGS

**When is the Combat Arms Earplug (CAE) in the Weapons Fire mode and when is it in the Constant Protection mode?**  
 When the rocker cover exposes the hole, you are in the Weapons Fire mode. In the closed position, the earplug is in the Constant Protection mode.

**When do I set the rocker cover for either Open/Weapons Fire or Closed/Constant Protection?**  
 If you are firing a weapon (in training or in combat) and you have to maintain situational awareness and hear verbal communication, set the rocker cover in the Open/Weapons Fire mode. For steady/continuous noise, like in a helicopter or tracked vehicle, set the rocker cover in the Closed/Constant Protection mode. You will be protected from weapons fire in either mode, but only from steady/continuous noise in the Closed mode.

**How does the CAE protect my hearing from weapons fire or explosions in the Open/Weapons Fire mode?**  
 The blast energy (impulse noise) must pass through two calibrated holes that filter the more hazardous sound energy. Think of the reduction of this sound energy as sound friction which increases as the impulse noise becomes louder. Meanwhile, lower level sounds like conversation get through the filter relatively unchanged.

**How protective is the CAE in the Open/Weapons Fire mode?**  
 When properly inserted, Army studies found the plug protective for impulse noise (weapons fire and explosions) up to 190 dB SPL. That covers the loudest weapons in the inventory at the fire's position.

**Why does weapons fire sound louder in the Open/Weapons Fire mode than the Closed/Constant Protection mode?**  
 More low-frequency sound energy, which is not as hazardous to hearing as high-frequency sound, gets through in the Open position.

**How do I determine the correct size?**  
 It is essential that someone with the appropriate training fits you with the correct size. Sizes are color-coded – small (blue), medium (tan) and large (brown). An ear gage will provide an approximation of the correct size, but the insertion of a trial earplug is needed to confirm. A recommended sizing distribution for a military population would be 25% small, 60% medium and 15% large. Approximately 1% will require a different size in each ear. There will be a shift toward the smaller sizes for females, African Americans and younger personnel. Conversely, there is a shift toward the larger sizes for Caucasian males.

**As long as it stays in my ear, will any size work? What's the problem if the size is a little off?**  
 You want these earplugs to be tough on noise, not your ears. For your own comfort and maximum protection, you want a size that fits best. The correct size also keeps the ear sealed without having to constantly reinsert the plug.

**How do I insert the earplug properly and know when it is in correctly?**  
 Reach behind your head and pull your ear out to straighten the ear canal; insert the earplug with your free hand. Gently tug on the earplug for a required tension. Your own voice will also sound low-toned, muffled even more so in the Closed mode. If the plugs do not appear to be blocking any sound, try again to reinsert them. If they still do not appear to be working, have a person trained in earplug fitting check you for the correct size. Remember, if you don't have them in correctly, you might as well not have them in at all.

**What is the best way to clean the earplug?**  
 Use plain soap and water only, no harsh chemicals or detergents. Ensure the soap is thoroughly rinsed off so no holes are clogged. For best results, separate the plug from the plastic housing and clean the plug separately.

**How do I know when to replace the Combat Arms earplug?**  
 Replace if the plug flanges become torn, harden or cannot be cleaned, or if the plastic housing is damaged.

**How should I store the earplugs?**  
 When not in use, keep in the plastic case provided or tie the cords to the helmet webbing for quick access.

**Can I remove the cord?**  
 Yes, it just snaps off. Note: the cord cannot be re-attached.

**Are any other modifications to the CAE recommended?**  
 None are recommended. Any other modifications could degrade the ability of the earplug to protect you from hazardous noise and/or interfere with your ability to maintain situational awareness and hear verbal communications.

# **EXHIBIT D**

19.FRENCH REPUBLIC                    11. Publication No.: **2 676 642**  
 NATIONAL INSTITUTE  
OF INDUSTRIAL PROPERTY                (to be used only for ordering reproductions)  
 PARIS                                    21. National Registration No.: **91 06150**  
 51. Int Cl<sup>5</sup>: A 61 F 11/08

12.

**INVENTION PATENT****B1****54. IMPROVED HEARING PROTECTION DEVICE**

22. Date of filing: 05/22/91

30. Priority:

43. Date application made available to the public: 11/27/92 Bulletin 92/48

45. Date the invention patent made available to the public: 05/15/98 Bulletin 98/20

56. List of documents cited in the search report:

*Refer to the end of this copy.*

60. References to other related national documents:

71. Applicant(s): INSTITUT FRANCO ALLEMAND DE RECHERCHES DE SAINT LOUIS (Bi-national research institute with its own legal identity in the territories of the French Republic and the French Republic [sic] and the Federal Republic of Germany).  
- FR

72. Inventor(s): DANCER ARMAND – FRANKE RODOLPHE

73. Holder(s):

74. Attorney(s): BOUJU DERAMBURE BUGNION LAW OFFICE

**FR 2 676 642 – B1**

The invention concerns a hearing protection device comprising means for selectively attenuating exterior sounds and means for maximum attenuation, nonselective, of said sounds, the mode of operating in selective attenuation or in maximum attenuation being selected by a manually controlled obturator.

Such equipment, which makes it possible to quickly select between two systems of protection, is particularly useful when the user is alternately exposed to loud noises that occur continuously or in impulses. This is the case, for example, of military aircraft or combat vehicle crews as well as infantrymen, who are exposed to continuous noises, sometimes at a high level (120 or 140 dB SPL), from engines, and occasional or intermittent impulse noises at high or even very high level (up to 190 dB SPL), such as noise from weapons.

This can also be the case for personnel working in quarries for boring tunnels with explosives. Continuous noise from coal cutters and other extraction machines and impulse noise from explosions can require the wearing of a hearing protective device of the improved type concerned by the invention.

Depending on the exposure conditions, the user of a protection device of the type defined above chooses, by a very simple gesture and without changing protective device, between two modes of operation: one in selective attenuation by which a filtering of sounds reaching the ear occurs, depending on their intensity and their frequency and according to whether they are impulse or continuous noises, and the other in maximum attenuation by which all sounds are attenuated.

In selective attenuation mode, the attenuation of sounds is weak for a defined range of frequencies, and it increases for sounds of a frequency above those of the defined range. When impulse sound is concerned,

the attenuation is immediate as soon as the sounds reach a sufficient level of intensity. One application of the functioning of selective attenuation hearing protection is the intelligible transmission of speech in an environment disturbed by impulse noise such as noise from weapons. In this case, the range of frequencies defined for a weak attenuation is characteristic of the intelligible transmission of speech (upper limit: 1000 to 3000 Hz).

Contrary to selective attenuation, which has a filtering function and becomes more effective as the impulse noise is stronger, the maximum attenuation blocks all sounds over the whole range of frequencies, irrespective of their nature and level.

A hearing protection device combining these two modes of attenuation is known from FR-A-2 014 846, in the form of a cup suitable for covering the ear of the user. Said cup comprises a selective attenuation acoustic filter and an acoustic valve for isolating the ear from outside noises. The selective attenuation operation uses the volume of air enclosed between the ear of the user and the cup as a capacitive element, as well as an element forming acoustic impedance. Because of its principle, this protection device is relatively large and incompatible with a protective helmet if it is not already integrated therein. Moreover, the presence of parts for centering and positioning filters expose the cup to sealing and functioning problems.

The purpose of the invention is to produce a hearing protection device that is reliable and not exposed to a maladjustment of its components, requires little space so that a protective helmet or mask can be worn, and is inexpensive to manufacture.

According to the invention, the hearing protection device of the type defined in the introduction is characterized in that it

comprises an elongated flexible body intended to come into sealed peripheral contact with the walls of the auditory canal, the flexible body being axially traversed by a channel in which the selective attenuation means are located, and in that the obturator is integral with the flexible body.

5 Because it is inserted in the auditory canal of the user, this protection device takes up the minimum amount of space, making it compatible with the wearing of a mask or helmet, preferably, in this case for operation in maximum attenuation mode. It combines the advantages of an "earplug" type of protection device with those of an improved hearing protection device filtering sounds  
10 based on a defined frequency range and their intensity.

Advantageously the flexible body is shaped like a truncated cone and it has on its outer surface flexible flanges of a diameter increasing from the downstream end to the upstream end.

15 The seal is thus achieved between the flexible body and the walls of the auditory canal, the former adapting perfectly to the latter and enabling it to be produced in only one size that can fit most auditory canals.

Preferably, the selective attenuation means are passive means that ensure a non-linear acoustic transmission in the linking channel.

Such transmission is advantageously obtained when the channel has, at  
20 the downstream end, a transverse partition in sealed peripheral contact with the walls of the canal, said partition having at least one opening to ensure the continuity of the channel that connects the two ends of the flexible body and the openings being calibrated to allow a defined range of frequencies to pass.

Thus, low-level sounds included in this range of frequencies have a  
25 laminar flow through the calibrated openings and are only weakly attenuated when they reach the user's eardrum.

However, high or very high level sounds have a turbulent flow and because of this they are attenuated. Impulse sounds are very attenuated whenever their intensity is sufficient to prevent their passage through the  
5 calibrated openings of the partition.

The non-linear acoustic transmission effect produced by the transverse partition with calibrated orifices can be advantageously reinforced when the channel that connects the two ends of the flexible body is composed of several channel sections coaxial to the flexible body.

10 In one particularly simple and economical embodiment, the obturator is a plug designed to be sealingly engaged in the upstream end of the flexible body.

Other features and advantages of the invention will be seen from the following description.

15 In the appended drawings given by way of non-limiting examples:

- figure 1 is a partial longitudinal cross-section of a hearing protection device according to the invention, placed in the auditory canal of a user, in maximum attenuation mode;

20 - figure 2 is a partial longitudinal cross-section in larger scale of the hearing protection device of figure 1;

- figure 3 is a partial longitudinal cross-section according to figure 2, the hearing protection device this time being in the selective attenuation mode;

- figure 4 is a partial longitudinal cross-section of a hearing protection device, according to a variation of the invention, in selective attenuation mode.

25 In the embodiment according to figures 1 to 3, the hearing protection device comprises an elongated body approximately 1.5 cm long, in the shape of a truncated cone, made of a flexible material such as a silicon rubber, polyester or polyethylene. The body 1 is axially traversed by a channel

2 which can be sealably blocked by a plug 3 attached to the wider end of the body 1 by a flexible cord 4. The plug 3 is made of a plastic material of a rigidity equal to or greater than that of the body 1. In addition to the materials  
5 mentioned for the body, it can also be made of Altuglas or epoxy resin.

Figure 1 shows the body 1 in place in the auditory canal 5 of a user, the narrower or downstream end facing the eardrum, while the wider or upstream end is outside in the auricle of the ear. The plug 3 is engaged in the channel 2, thus closing the communication between the upstream and downstream ends of  
10 the flexible body 1, providing maximum attenuation protection from exterior sounds. The cord 4 of the plug 3 can serve as a stop for the insertion of the protection device into the auditory canal 5 and also can be used as a grip to remove it.

Flexible annular flanges 6, integral with the outer surface of the flexible body 1, provide the seal between the body 1 and the walls of the auditory canal 5. Said flanges have a diameter that increases from the downstream part to the upstream part, which, combined with the truncated cone shape of the body 1, enables the protection device to be inserted more or less deeply into the auditory canal, depending on the shape of said canal, at least the flange located  
15 uppermost inside the canal 5 guaranteeing the peripheral seal by pressing against the walls of said canal.

A description will now be provided of the selective attenuation means that are characteristic of the hearing protection device according to the invention. Irrespective of the embodiment considered, whether that of figures 1  
20 to 3 or the variation of figure 4, the selective attenuation means are located in the channel which connects the upstream and downstream ends of the flexible body 1.

With reference to figures 1 to 3, the channel 2 is composed of two main sections, 7 and 8, which are

distinguished in particular by their different cross-section. The two sections 7, 8 each have a constant cylindrical cross-section but the upstream end of the

5 section 7 is abruptly narrowed by an annular shoulder 9 the inside diameter of which is determined by the cross-section of the channel section 8. In the wall 8a of the channel 2, near the downstream end of the flexible body 1 an annular groove 10 is made in which a transverse washer 11 is held in peripheral sealed contact with the wall 8a of the channel 2. The washer 11 is composed of a more 10 rigid material than that of the body 1, because it is important that it not be deformed when it is inserted into the ear. It can be made of a corrosion-resistant metal (such as stainless steel, chrome plated or gilded brass) or of a rigid plastic material (such as Altuglas or Teflon). Its outside diameter is between 2 and 5 mm, depending on its placement in the flexible body 1 and on the size of said 15 body.

The washer 11 has a central hole 12 calibrated to allow a defined range of frequencies to pass. The calibration of the hole can thus be adapted to allow frequencies not exceeding 3000 Hz to pass if it is desired that frequencies characteristic of speech transmission be allowed to pass (upper limit of 1000 to 20 3000 Hz) reaching, without noticeable attenuation, the inner ear of the user. The calibration of the central hole for a certain range of frequencies causes, in the presence of high level impulse sounds (more than 120 or 140 dB SPL), the formation of turbulences that hinders their transmission and results in a noticeable attenuation for the user. High, or even very high, intensity impulse 25 sounds (up to 190 dB SPL) will be particularly attenuated because they strike the washer 11 and will only be able to pass through the calibrated opening 12 by undergoing strong attenuation.

Tests have shown that, in order to favor intelligible transmission of speech, for example

orders given to the user, and to preserve the ability of said user to identify and  
5 locate sources of sound, the hole 12 must have a diameter between 0.1 and 0.7 mm, the axial thickness of the washer being between 0.1 and 5 mm. The larger the calibrated hole 12, the higher the threshold of frequencies beyond which there is practically no attenuation. The calibration of the hole 12, the axial thickness of the washer 11, its placement in the channel 2 and the cross-section  
10 of the channel sections 7 and 8 can be determined in such a way as to attenuate preferentially this or that domain of frequencies deemed to be harmful, to which the user could be exposed, while still optimizing the transmission of spoken communication.

Thus, when the channel 2 is not blocked by the plug 3, it places the  
15 eardrum of the user in communication with the outside noises. The structure of the channel ensures, between the two ends of the flexible body 1, a passive-type nonlinear acoustic transmission that results in a selective attenuation of sounds based on their frequency, intensity and nature (continuous or impulse sounds). In the application promoting the transmission of speech, the user receives  
20 spoken communication messages while being protected against high or very high level impulse noises, such as the noises from weapons or deflagrations.

The selective attenuation means also attenuate continuous noises of a frequency above a fixed threshold, as well as high intensity continuous noises by preventing their laminar flow. Turbulences are formed and attenuate the  
25 transmission of these sounds but their attenuation is insufficient to save the user auditory fatigue since these continuous noises are of a high intensity and duration such as transportation noises. In this case, the user engages, by a simple gesture of the hand, the plug 3 in the canal 2.

Blocked in this way (figures 1 and 2) the hearing protection device functions in  
5 maximum attenuation mode. All of the auditory canal of the user is sealed and isolated from outside noises over the whole range of frequencies.

The annular shoulder 9 by which the cross section of the channel 2 is narrowed at the downstream end of the section 7 serves as a stop of the insertion of the plug 3. Said plug, once in place in the channel section 7,  
10 protrudes enough to be able to be extracted without removing the protective device, when the user wishes to change back to selective attenuation operation.

A variation of embodiment will now be described, with reference to figure 4.

The flexible body 1 is axially traversed by a channel 20 composed of a  
15 succession of cylindrical sections of different cross section which ensures a non-linear acoustic transmission. The flexible body 1 has in its median part a transverse partition 21 integral with said body and of the same axis Y-Y' as the flexible body 1. Said body is traversed by a plurality of orifices 23, only two of which are visible in cross-section in figure 4, but there are preferably six or  
20 eight of them and they have an axis parallel to the axis Y-Y'. The orifices 23 are situated on the same annular ring that delimits a solid zone 24 of the partition 21, on which is centered, on the face 25 turned towards the upstream end of the flexible body, a rod 26 with an axis Y-Y', cylindrical in cross section, integral with the flexible body 1 and the transverse partition 24. The rod 26 extends  
25 beyond the upstream end of the flexible body 1 and ends with a stop 27. Slidably mounted on this rod 26 is a plug 35 with an axis of Y-Y', composed of one of the plastic materials indicated for the plug 3 in the previously described embodiment.

The orifices 23 are connected upstream to an annular space 22 defined between the inner wall 28 of the flexible body 1, upstream from the partition 21, and the rod 26.

Downstream, the orifices 23 lead to a channel section 29 of the same axis Y-Y'  
5 as the flexible body 1. The downstream end of the channel section is abruptly narrowed by an annular shoulder 30 that defines the cross-section of the channel section 31 at the downstream end of the channel 20. In the wall of the section 31 an annular groove 39 is made, in which a washer 33 is maintained in sealed peripheral contact, similar to the washer 11 of the embodiment in figures  
10 1 to 3, and traversed by a calibrated central orifice 34.

The succession of channel sections 22, 23, 29 and 31, with the interposition in the latter of the partition 33 with calibrated orifice, ensures, as in the embodiment of figures 1 to 3, a non-linear acoustic transmission that results in a selective attenuation of sounds based on the range of frequencies chosen to pass through the calibrated orifice 34 in laminar form. The passage of high intensity sounds is affected by turbulences that attenuate them. High or very high intensity impulse sounds are blocked so that the user receives them extremely attenuated.  
15

As can be seen in figure 4, the channels 23 with parallel axis lead to an annular enlarged shoulder 32 in the channel section 29 with Y-Y' axis, while in principle the downstream ends of the channel sections lead to a channel section of smaller cross section. The enlargement of the cross section at the outlet of the channels 23 makes it possible, due to the proximity of the narrowed shoulder 30, to avoid turbulences forming also during the passage of frequencies in the range chosen for minimal attenuation. However, the channel section 22 with Y-Y' axis leads to a coaxial channel section 29 of smaller cross section, the  
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narrowing being achieved by the annular shoulder 25 of the transverse partition 24 up to the ring of orifices 23.

The plug 35 slides freely over a length of rod a between two enlargements 40, 41 of the

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cross section of the rod 26; beyond said enlargements the sliding of the plug 35, downstream and upstream, respectively, is done with friction. The enlargement 40, which delimits on the portion of rod situated inside the flexible body 1, a zone b of enlarged cross section, thus ensures the peripheral seal between the 10 zone b of the rod 26 and the wall of the central orifice 36 of the plug 35, when said plug is engaged in the annular space 22. The enlargement 41 ensures, up to the stop 27, the blockage of the plug 30 on the rod portion c, in a position remote from the upstream end of the flexible body 1 in order not to hinder the transmission of outside sounds.

15 At its downstream part the plug 35 is composed of a cylindrical body 37, of a diameter substantially equal to or slightly greater than that of the space 22 in order to ensure a sealed closure, and it is surmounted upstream by a cylindrical plate 38, centered on the body 37 and of a larger diameter than said body. The plate 38 serves as a stop of the insertion of the plug 35 and 20 contributes to ensuring the peripheral seal between the plug and the inner wall 28 of the flexible body 1.

Between the stop 27 and the sealed closure position in which the plate 38 is stopped against the upstream end of the flexible body 1, the user can freely move the plug 35 over the rod 26 for greater or lesser attenuation of 25 outside sounds. The variation of embodiment according to figure 4 thus offers additional progressive attenuation means between the selective attenuation mode and the maximum attenuation mode.

The hearing protection device according to the invention allows the user to quickly select a protection mode based on exposure conditions. It is particularly suitable for operational stresses encountered in a military environment, due to the numerous advantages it has: light-weight, low cost,  
5 robust, compatibility with other equipment such as.

helmets, headbands, masks, etc.

Of course, the invention is not limited to the embodiments described, and numerous modifications can be made thereto without going beyond the  
10 scope of the invention.

Thus, instead of a single calibrated orifice, the partition can include a plurality of them in the form of holes or slots the cross section of which is smaller as they increase in number.

The obturator allowing operation in maximum attenuation mode could  
15 be composed of a rotary valve or any other means allowing communication to be cut off between the two ends of the flexible body.

CLAIMS

1. Hearing protection device comprising an elongated flexible body (1) intended to come into sealed peripheral contact with the walls of the auditory canal (5), the flexible body (1) being axially traversed by a channel (2, 20) in which a transverse partition (11, 33) is situated in sealed peripheral contact with the walls of the channel (2, 20), said partition (11, 23) having at least one opening (12, 34) calibrated to allow a defined range of frequencies to pass, while the protection device includes means of selective attenuation of exterior sounds and means of non-selective maximum attenuation of said sounds, the mode of operation in selective attenuation or in maximum attenuation being selected by means of a manually controlled obturator, characterized in that the transverse partition (11, 33) is made of a material more rigid than that of the body (1).

15 2. Hearing protective device according to claim 1, characterized in that the partition (11, 33) has an axial thickness of between 0.1 and 5 mm and has one or more holes (12, 34) of a diameter between 0.1 and 0.7 mm.

20 3. Hearing protective device according to either of claims 1 or 2, characterized in that the transverse partition (11, 33) has an outside diameter between 2 and 5 mm.

4. Hearing protection device according to any one of claims 1 to 3, characterized in that the channel (2, 20) is composed of a plurality of channel sections (7, 8; 22, 23, 29, 31) ensuring a non-linear acoustic transmission.

25 5. Hearing protection device according to claim 4, characterized in that the channel (2, 20) has a plurality of channel sections (7, 8; 22, 39, 31) that are coaxial with the flexible body, the upstream section (7; 22, 29) leading by an annular shoulder (9; 25, 30) into a downstream section (8; 29, 31) of smaller cross section.

30 6. Hearing protection device according to either of claims 4 or 5, characterized in that the channel (20) includes channel sections (23) that are non-coaxial with the flexible body (1) leading at their downstream end by an annular enlargement shoulder (32) into a channel section (29) that is coaxial with the flexible body (1).

7. Hearing protection device according to any one of claims 1 to 6, comprising a plug designed to be sealably engaged in the upstream end of the flexible body (1), characterized in that the plug (3) is connected to the upstream end of the flexible body (1) by a cord (4) that is integral therewith.

5 8. Hearing protection device according to claim 7, characterized in that the channel (2) is composed of channel sections (7, 8) the first (7) of which, starting from the upstream end leads by an annular shoulder (9) into a coaxial section (8) of smaller cross-section, and in that said annular shoulder (9) constitutes a stop for insertion of the plug (3).

10 9. Hearing protection device according to any one of claims 1 to 6, comprising a plug designed to be sealably engaged in the upstream end of the flexible body (1), characterized in that the plug (35) is slidably mounted along a rod (26) which is centered inside the flexible body (1) and projects outward at the upstream end.

15 10. Hearing protection device according to claim 9, characterized in that the rod (26) has a cross-section (40) that is wide enough inside the flexible body to make a sealing contact between the rod (26) and the plug (35) when said plug closes off the flexible body (1).

20 11. Hearing protection device according to either of claims 9 or 10, characterized in that the rod (26) comprises between its two ends (24, 27) a zone (a) along which the plug (35) slides freely, said zone (a) being located between two zones (b, c) along which the plug (35) slides with friction.

25 12. Hearing protection device according to any one of claims 1 to 11, characterized in that the flexible body (1) is shaped like a truncated cone and includes on its outer surface flexible flanges (6) of a diameter that increases from the downstream end to the upstream end.

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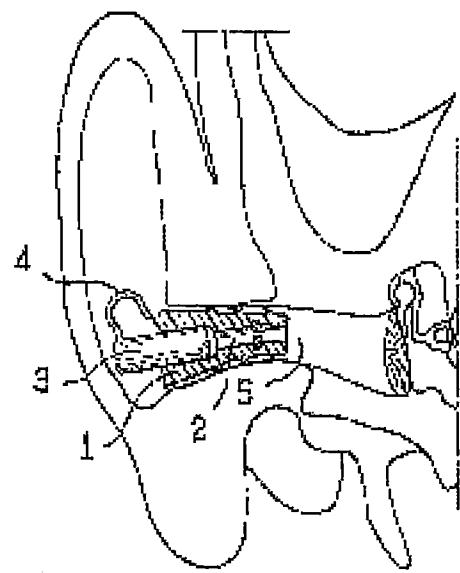


FIG. 1

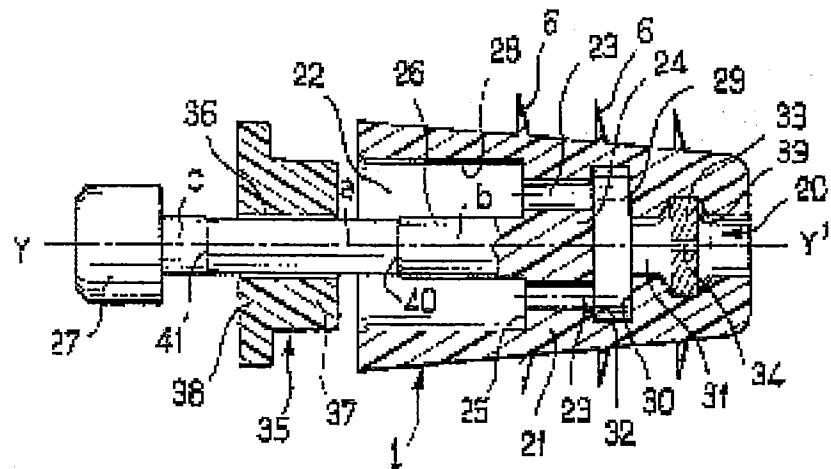


FIG. 4

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FIG. 2

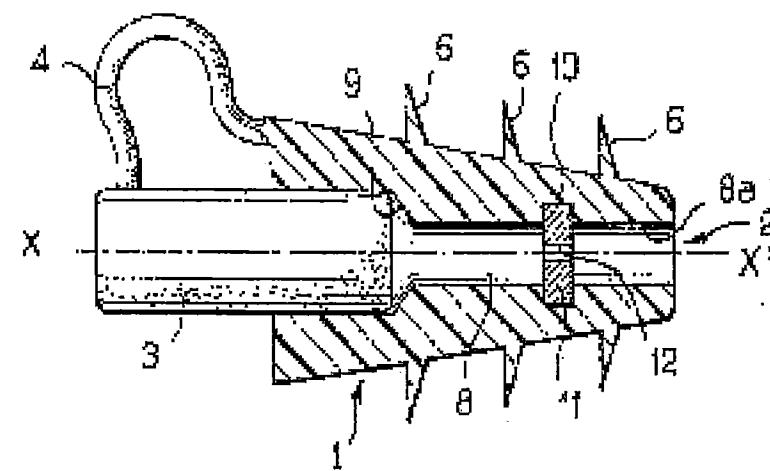
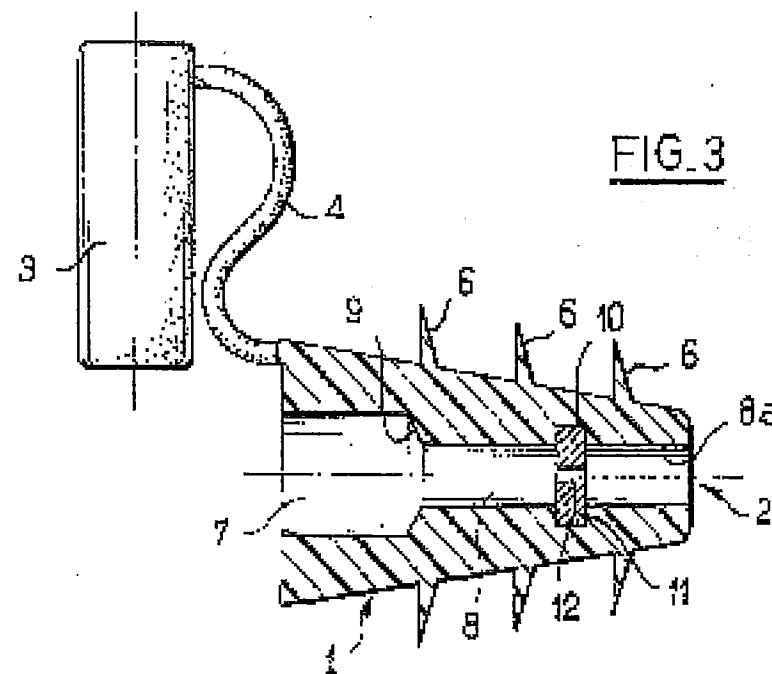


FIG. 3



# SEARCH REPORT

Articles L.612-14, L.612-17 and R.612-53 to 69 of the Intellectual Property Code

## PURPOSE OF THE SEARCH REPORT

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After completion of the procedures specified by the laws mentioned above, the patent is issued. The National Industrial Property Institute [INPI], except in a case of obvious absence of novelty, is not authorized to refuse issuance. The validity of a patent is a matter solely for the courts.

However, the INPI must attach to each patent a "SEARCH REPORT" citing the elements of the prior art that can be taken into consideration in evaluating the patentability of the invention. This report concerns the claims included in the patent that define the object of the invention and limit the extent of protection.

After issuance, the INPI can, at the request of any interested person, formulate a "DOCUMENTARY REPORT" based on the documents cited in the search report and any other document that the petitioner wishes to have taken into consideration.

## CONDITIONS FOR PREPARING THIS SEARCH REPORT

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- The applicant has submitted observations in response to the preliminary search report.
- The applicant has maintained the claims.
- The applicant has modified the claims.
- The applicant has modified the description in order to eliminate the elements that were not in agreement with the new claims.
- Third parties have submitted observations after publication of the preliminary search report.
- An additional preliminary search report has been prepared.

## DOCUMENTS CITED IN THIS SEARCH REPORT

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The distribution of documents among sections 1, 2 and 3 takes into account, if applicable, the last claims filed and/or observations submitted.

- The documents listed in section 1 hereinafter can be taken into consideration in evaluating the patentability of the invention.
- The documents listed in section 2 hereinafter illustrate the general technological background.
- The documents listed in section 3 hereinafter have been cited during the proceeding, but their pertinence depends on the validity of the priorities claimed.
- No document was cited during the proceeding.

National registration number: 91 06150

Publication No. 2676642

**1 ELEMENTS OF THE PRIOR ART THAT CAN BE TAKEN INTO  
CONSIDERATION IN EVALUATING THE PATENTABILITY OF THE INVENTION**

| Document reference<br>(indicating, if applicable, the pertinent parts)                                 | Patent claims<br>concerned |
|--------------------------------------------------------------------------------------------------------|----------------------------|
| US - A - 4 353 364 (WOODS)<br>* column 4, line 30 – column 5, line 46; figures 4, 6, 7 *               | 1-7, 12                    |
| DE - A - 2 808 525 (KACO GMBH)<br>* page 7, line 5 – page 8, line 7; figure 1 *                        | 12                         |
| FR - A - 1 043 046 (ZWISLOCKI)<br>* page 2, left column, line 3 – right column *                       | 1, 2, 12                   |
| FR - A - 2 095 127 (SANTI LOUIS)<br>* page 1, line 33 – page 2, line 12; claims 1, 2;<br>figures 2, 3* | 1 – 5                      |
| EP - A - 0 112 594 (DE BOER ET AL.)<br>* claims; figures 1, 2 *                                        | 1 – 6                      |
| US - A - 4 896 679 (ST PIERRE)<br>* figure 7 *                                                         | 7                          |
| US - A - 2 881 59 (HOCKS ET AL.)<br>* claim 1, figures 2, 3 *                                          | 9 – 11                     |

**2 ELEMENTS OF THE PRIOR ART ILLUSTRATING THE  
GENERAL TECHNOLOGICAL BACKGROUND**

US - A - 2 458 884 (VOLKMANN)

**3 ELEMENTS OF THE PRIOR ART WHOSE PERTINENCE  
DEPENDS ON THE VALIDITY OF THE PRIORITIES**

| Document reference<br>(indicating, if applicable, the pertinent parts) | Patent claims<br>concerned |
|------------------------------------------------------------------------|----------------------------|
| NONE                                                                   |                            |

(19) RÉPUBLIQUE FRANÇAISE

INSTITUT NATIONAL  
DE LA PROPRIÉTÉ INDUSTRIELLE

PARIS

(11) N° de publication :

(à n'utiliser que pour les  
commandes de reproduction)**2 676 642**(21) N° d'enregistrement national : **91 06150**(51) Int Cl<sup>6</sup> : A 61 F 11/08

(12)

**BREVET D'INVENTION****B1**

(54) PROTECTION AUDITIVE PERFECTIONNEE.

(22) Date de dépôt : 22.05.91.

(30) Priorité :

(60) Références à d'autres documents nationaux  
apparentés :(43) Date de la mise à disposition du public  
de la demande : 27.11.92 Bulletin 92/48.(45) Date de la mise à disposition du public du  
brevet d'invention : 15.05.98 Bulletin 98/20.(71) Demandeur(s) : INSTITUT FRANCO ALLE-  
MAND DE RÉCHERCHES DE SAINT-LOUIS  
(Institut de recherches binational à personnalité  
juridique sur les territoires de la République  
Française et la République Française et la Ré-  
publique Fédérale d'Allemagne). -FR.(56) Liste des documents cités dans le rapport  
de recherche :*Se reporter à la fin du présent fascicule*(72) Inventeur(s) : DANCER ARMAND - FRANKE  
RODOLPHE

(73) Titulaire(s) :

(74) Mandataire(s) : CABINET BOUJU DERAM-  
BURE BUGNION**FR 2 676 642 - B1**

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L'invention concerne une protection auditive comportant des moyens d'atténuation sélective des sons extérieurs et des moyens d'atténuation maximale, non sélective, de ces sons, le mode de fonctionnement en 5 atténuation sélective ou en atténuation maximale étant sélectionné à l'aide d'un obturateur à commande manuelle.

Un tel équipement, qui permet une sélection rapide entre deux régimes de protection, est particulièrement utile lorsque l'utilisateur est exposé à des bruits élevés qui se 10 manifestent tour à tour de manière continue et de manière impulsionale. C'est le cas par exemple des équipages d'avions militaires ou de véhicules de combat en exercice, ainsi que des fantassins, qui sont exposés aux bruits continus, parfois de niveau élevé (120 ou 140 dB SPL), des 15 moteurs, et à des bruits impulsionnels, occasionnels ou intermittents et de niveau élevé ou même très élevé (jusqu'à 190 dB SPL), tels que des bruits d'armes.

Ce peut être le cas également du personnel travaillant à l'exploitation de carrières ou à la percée de 20 tunnels à l'explosif. Le bruit continu des haveuses et autres engins d'extraction et le bruit impulsional des explosions peuvent nécessiter le port d'une protection auditive du type perfectionné concerné par l'invention.

En fonction des conditions d'exposition, 25 l'utilisateur d'une protection du type défini plus haut choisit, par un geste très simple et sans changer de protection, entre deux modes de fonctionnement: l'un en atténuation sélective, par lequel s'opère un filtrage des sons parvenant à l'oreille, en fonction de leur intensité et 30 de leur fréquence et selon qu'il s'agit de bruits impulsionnels ou continus, et l'autre en atténuation maximale par lequel tous les sons sont atténués.

En mode d'atténuation sélective, l'atténuation des sons est faible pour une gamme de fréquences définie, et elle 35 augmente pour les sons de fréquence supérieure à ceux de la gamme définie. Lorsqu'il s'agit de sons impulsionnels,

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l'atténuation est immédiate dès lors que les sons atteignent un niveau d'intensité suffisant. Une application du fonctionnement d'une protection auditive en atténuation sélective est la transmission intelligible de la parole dans un environnement perturbé par des bruits impulsionnels tels que des bruits d'armes. Dans ce cas, la gamme de fréquences définie pour une faible atténuation est celle caractéristique de la transmission intelligible de la parole (limite supérieure: 1 000 à 3 000 Hz).

Contrairement à l'atténuation sélective, qui a une fonction de filtre et est d'autant plus efficace que le bruit impulsional est plus fort, l'atténuation maximale bloque tous les sons sur toute la gamme des fréquences et indépendamment de leur nature et de leur niveau.

Une protection auditive combinant ces deux modes d'atténuation est connue d'après le FR-A-2 014 846, sous la forme d'une coquille adaptée pour recouvrir l'oreille de l'utilisateur. Cette coquille comprend un filtre acoustique à atténuation sélective et un clapet acoustique pour isoler l'oreille des bruits extérieurs. Le fonctionnement en atténuation sélective utilise le volume d'air, enfermé entre l'oreille de l'utilisateur et la coquille, comme élément capacitif, ainsi qu'un élément formant impédance acoustique. Par son principe même, cette protection est relativement volumineuse et non compatible avec un casque de protection si elle n'est pas déjà intégrée à ce dernier. En outre, la présence de pièces de centrage et de positionnement des filtres exposent la coquille à des problèmes d'étanchéité et de fonctionnement.

L'invention a pour but de réaliser une protection auditive qui soit fiable et non exposée à un déréglage de ses composants, peu encombrante de manière à autoriser accessoirement le port d'un casque de protection ou d'un masque, et de faible coût de fabrication.

Suivant l'invention, la protection auditive du type défini en introduction est caractérisée en ce qu'elle

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comprend un corps souple allongé destiné à venir en contact périphérique étanche avec les parois du conduit auditif, le corps souple étant traversé axialement par un canal dans lequel sont situés les moyens d'atténuation sélective, et en 5 ce que l'obturateur est solidaire du corps souple.

Du fait qu'elle s'insère dans le conduit auditif de l'utilisateur, cette protection présente un encombrement minimum qui la rend compatible avec le port d'un masque ou d'un casque, de préférence, dans ce cas, pour un 10 fonctionnement en mode d'atténuation maximale. Elle allie les avantages d'une protection du type "bouchon d'oreille" à ceux d'une protection acoustique perfectionnée filtrant les sons en fonction d'une gamme de fréquence définie et de leur intensité.

15 Avantageusement, le corps souple est tronconique et comporte sur sa surface extérieure des flasques souples de diamètre croissant de l'extrémité aval à l'extrémité amont.

L'étanchéité est ainsi réalisée entre le corps souple et les parois du conduit auditif, le premier 20 s'adaptant parfaitement au second et permettant sa réalisation dans une seule taille pour convenir à la plupart des conduits auditifs.

De préférence, les moyens d'atténuation sélective sont des moyens passifs qui assurent, dans le canal de 25 liaison, une transmission acoustique non linéaire.

Une telle transmission est avantageusement obtenue lorsque le canal comporte, du côté de son extrémité aval, une cloison transversale en contact périphérique étanche avec les parois du canal, cette cloison présentant au moins une 30 ouverture assurant la continuité du canal qui relie les deux extrémités du corps souple et les ouvertures étant calibrées pour laisser passer une gamme de fréquences définie.

Ainsi, les sons de faible niveau compris dans cette 35 gamme de fréquences ont un écoulement laminaire à travers les ouvertures calibrées et ne sont que très faiblement atténués lorsqu'ils parviennent au tympan de l'utilisateur. Par

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contre, les sons de niveau élevé ou très élevé ont un écoulement turbulent et sont de ce fait atténusés. Les sons impulsionnels sont très atténusés dès lors que leur intensité est suffisante pour empêcher leur passage à travers les ouvertures calibrées de la cloison.

L'effet de transmission acoustique non linéaire produit par la cloison transversale à orifices calibrés peut être avantageusement renforcé lorsque le canal qui relie les deux extrémités du corps souple est constitué de plusieurs tronçons de canal coaxiaux au corps souple.

Dans un mode de réalisation particulièrement simple et économique, l'obturateur est un bouchon conçu pour s'engager de manière étanche dans l'extrémité amont du corps souple.

D'autres particularités et avantages de l'invention apparaîtront encore dans la description ci-après.

Aux dessins annexés donnés à titre d'exemples non limitatifs:

- la figure 1 est une coupe longitudinale partielle d'une protection auditive conforme à l'invention, placée dans le conduit auditif d'un utilisateur, en mode d'atténuation maximale;

- la figure 2 est une coupe longitudinale partielle à plus grande échelle de la protection auditive de la figure 1;

- la figure 3 est une coupe longitudinale partielle, conforme à la figure 2, la protection auditive étant cette fois en mode d'atténuation sélective;

- la figure 4 est une coupe longitudinale partielle, d'une protection auditive, selon une variante de l'invention, en mode d'atténuation sélective.

Dans la réalisation selon les figures 1 à 3, la protection auditive comprend un corps allongé 1 d'environ 1,5 cm de longueur, de forme tronconique, en une matière souple telle qu'un caoutchouc silicone, un polyester ou polyéthylène. Le corps 1 est traversé axialement par un canal

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2 qui peut être obturé de manière étanche par un bouchon 3 rattaché à l'extrémité la plus large du corps 1 par un cordon souple 4. Le bouchon 3 est fait d'une matière plastique de rigidité supérieure ou égale à celle du corps 1. Outre les 5 matières citées pour le corps, il peut être en altuglass ou résine époxy.

A la figure 1 on voit le corps 1 en place dans le conduit auditif 5 d'un utilisateur, l'extrémité la moins large ou extrémité aval étant du côté du tympan, tandis que 10 l'extrémité la plus large, ou extrémité amont, donne sur l'extérieur dans le pavillon de l'oreille. Le bouchon 3 se trouve engagé dans le canal 2, fermant ainsi la communication entre les extrémités amont et aval du corps souple 1 de sorte que la protection se trouve en mode d'atténuation maximale 15 des sons extérieurs. Le cordon 4 du bouchon 3 peut servir de butée à l'enfoncement de la protection dans le conduit auditif 5 et constitue également une prise pour son retrait.

Des flasques annulaires souples 6, venues de matière sur la surface extérieure du corps souple 1, assurent 20 l'étanchéité entre le corps 1 et les parois du conduit auditif 5. Ces flasques sont de diamètre croissant de l'aval à l'amont, ce qui, combiné à la forme tronconique du corps 1, permet d'enfoncer la protection plus ou moins profondément 25 dans le conduit auditif, en fonction de la forme de ce dernier, au moins le flaque situé le plus en amont à l'intérieur du conduit 5 garantissant l'étanchéité périphérique en prenant appui contre les parois de ce dernier.

On va maintenant décrire les moyens d'atténuation 30 sélective caractéristiques de la protection auditive conforme à l'invention. Quelle que soit la réalisation considérée, celle des figures 1 à 3 ou bien la variante de la figure 4, les moyens d'atténuation sélective sont situés dans le canal qui relie les extrémités amont et aval du corps souple 1.

En référence aux figures 1 à 3, le canal 2 est 35 composé de deux tronçons principaux, 7 et 8, qui se

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distinguient en particulier par leur section différente. Les deux tronçons 7, 8 sont chacun de section cylindrique constante mais l'extrémité aval du tronçon 7 se rétrécit de manière abrupte par un épaulement annulaire 9 dont le 5 diamètre intérieur détermine la section du tronçon de canal 8. Dans la paroi 8a du canal 2, du côté de l'extrémité aval du corps souple 1, est ménagée une gorge annulaire 10 dans laquelle est maintenue, en contact périphérique étanche avec la paroi 8a du canal 2, une rondelle transversale 11. La 10 rondelle 11 est constituée d'une matière plus rigide que celle du corps 1 car il importe qu'elle ne se déforme pas du fait de son introduction dans l'oreille: elle peut être en métal inoxydable (par ex. en acier inox, laiton chromé ou doré) ou en une matière plastique rigide (par ex. en 15 altuglass ou téflon). Son diamètre extérieur est compris entre 2 et 5 mm, en fonction de son emplacement dans le corps souple 1 et de la taille de ce dernier.

La rondelle 11 présente un trou central 12 calibré pour laisser passer une gamme de fréquences définie. Le 20 calibrage du trou peut ainsi être adapté pour laisser passer les fréquences n'excédant pas 3 000 Hz si l'on souhaite que les fréquences caractéristiques de la transmission intelligible de la parole (limite supérieure de 1 000 à 3 000 Hz) atteignent, sans atténuation sensible, l'oreille 25 interne de l'utilisateur. Le calibrage du trou central pour une certaine gamme de fréquences entraîne, en présence de sons impulsionnels de niveau élevé (plus de 120 ou 140 dB SPL), la formation de turbulences qui gêne leur transmission et se traduit par une atténuation sensible pour 30 l'utilisateur. Les sons impulsionnels d'intensité élevée ou même très élevée (jusqu'à 190 dB SPL) seront particulièrement atténués car ils percuteront la rondelle 11 et ne pourront franchir l'ouverture calibrée 12 qu'en subissant une forte atténuation.

35 Les essais ont montré que, pour favoriser une transmission intelligible de la parole, par exemple des

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ordres donnés à l'utilisateur, et pour préserver la faculté de ce dernier d'identifier et de localiser les sources sonores, le trou 12 devait avoir un diamètre compris entre 0,1 et 0,7 mm, l'épaisseur axiale de la rondelle étant 5 comprise entre 0,1 et 5 mm. Le seuil de fréquences en-deçà duquel il n'y a pratiquement pas d'atténuation est d'autant plus élevé que le trou calibré 12 est plus grand. Le calibrage du trou 12, l'épaisseur axiale de la rondelle 11, son emplacement dans le canal 2 et la section des tronçons de 10 canal 7 et 8 peuvent être déterminés de manière à atténuer préférentiellement tel ou tel domaine de fréquences jugé nocif, auquel l'utilisateur est susceptible d'être exposé, tout en optimisant la transmission de la communication parlée.

15 Ainsi, lorsque le canal 2 n'est pas obturé par le bouchon 3, il met le tympan de l'utilisateur en communication avec les bruits extérieurs. La structure du canal assure entre les deux extrémités du corps souple 1 une transmission acoustique non linéaire de type passif qui se traduit par une 20 atténuation sélective des sons en fonction de leur fréquence, de leur intensité et leur nature (sons continus ou impulsionnels). Dans l'application privilégiant la transmission de la parole, l'utilisateur reçoit les messages de communication parlée tout en étant protégé contre les 25 bruits impulsionnels élevés ou très élevés, tels que les bruits d'armes ou les déflagrations.

Les moyens d'atténuation sélective atténuent également les bruits continus d'une fréquence supérieure au seuil fixé, ainsi que les bruits continus d'intensité élevée 30 en empêchant leur écoulement laminaire. Des turbulences se forment et atténuent la transmission de ces sons mais leur atténuation est insuffisante pour épargner à l'utilisateur une fatigue auditive dès lors que ces bruits continus sont d'intensité et de durées élevées comme peuvent l'être les 35 bruits de transport. Dans ce cas, l'utilisateur engage, d'un simple geste de la main, le bouchon 3 dans le canal 2. Ainsi

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obturée (figures 1 et 2), la protection auditive fonctionne en mode d'atténuation maximale: l'ensemble du conduit auditif de l'utilisateur est isolé de manière étanche des bruits extérieurs sur toute la gamme des fréquences.

5 L'épaulement annulaire 9 par lequel se rétrécit la section du canal 2 à l'extrémité aval du tronçon 7, sert de butée à l'enfoncement du bouchon 3. Ce dernier, une fois en place dans le tronçon de canal 7, fait suffisamment saillie pour pouvoir en être extrait sans retirer la protection, 10 lorsque l'utilisateur veut rétablir le mode de fonctionnement en atténuation sélective.

On va maintenant décrire une variante de réalisation, en référence à la figure 4:

15 Le corps souple 1 est traversé axialement par un canal 20 constitué d'une succession de tronçons cylindriques de section différente qui assurent une transmission acoustique non linéaire. Le corps souple 1 comporte, dans sa partie médiane une cloison transversale 21 venue de matière et de même axe YY' que le corps souple 1. Cette dernière est 20 traversée de plusieurs orifices 23, dont seulement deux sont visibles sur la figure 4 en coupe, mais qui sont de préférence au nombre de six ou huit et sont d'axe parallèle à l'axe YY'. Les orifices 23 sont situés sur une même couronne annulaire qui délimite une zone pleine 24 de la cloison 21, 25 sur laquelle est centrée, du côté de la face 25 tournée vers l'extrémité amont du corps souple, une tige 26 d'axe YY', de section cylindrique, venue de matière avec le corps souple 1 et la cloison transversale 24. La tige 26 s'étend au-delà de l'extrémité amont du corps souple 1 et se termine par une 30 butée 27. Sur cette tige 26 est monté coulissant un bouchon 35 d'axe YY' constitué en l'un des matériaux de matière plastique indiqués pour le bouchon 3 de la réalisation précédemment décrite.

35 Les orifices 23 sont reliés en amont à un espace annulaire 22 défini entre la paroi intérieure 28 du corps souple 1, en amont de la cloison 21, et la tige 26. A l'aval,

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les orifices 23 débouchent dans un tronçon de canal 29 de même axe YY' que le corps souple 1. L'extrémité aval du tronçon de canal 29 est rétrécie de manière abrupte par un épaulement annulaire 30 qui définit la section du tronçon de 5 canal 31 à l'extrémité aval du canal 20. Dans la paroi du tronçon 31 est ménagée une gorge annulaire 39 dans laquelle est maintenue, en contact périphérique étanche, une rondelle 33, analogue à la rondelle 11 de la réalisation des figures 1 à 3, et traversée par un orifice central 34 calibré.

10 La succession des tronçons de canal 22, 23, 29 et 31, avec interposition dans ce dernier de la cloison 33 à orifice calibré, assurent, comme dans la réalisation des figures 1 à 3, une transmission acoustique non linéaire qui se traduit par une atténuation sélective des sons en fonction 15 de la gamme de fréquences choisie pour traverser en régime laminaire l'orifice calibré 34. Le passage des sons d'intensité élevée est affecté par des turbulences qui les atténuent. Les sons impulsifs d'intensité élevée ou très élevée sont bloqués de sorte que l'utilisateur les reçoit 20 extrêmement atténusés.

Comme on le remarque à la figure 4, les canaux 23 d'axe parallèle débouchent par un épaulement annulaire d'élargissement 32 dans le tronçon de canal 29 d'axe YY', alors qu'en principe les tronçons de canal débouchent par 25 leur extrémité aval dans un tronçon de canal de section inférieure. L'élargissement de la section à la sortie des canaux 23 permet d'éviter, du fait de la proximité de l'épaulement de rétrécissement 30, que des turbulences ne se forment également lors du passage des fréquences appartenant 30 à la gamme choisie pour une atténuation minimale. Par contre, le tronçon de canal 22 d'axe YY' débouche dans un tronçon de canal coaxial 29 de section inférieure, le rétrécissement étant réalisé par l'épaulement annulaire 25 de la cloison transversale 24 jusqu'à la couronne d'orifices 23.

35 Le bouchon 35 coulisse librement sur une longueur de tige a comprise entre deux élargissements 40, 41 de la

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section de la tige 26 au-delà desquels le coulissement du bouchon 35, vers l'aval et vers l'amont, respectivement, se fait avec friction. L'élargissement 40, qui délimite sur la partie de tige située à l'intérieur du corps souple 1, une zone b de section élargie, assure ainsi l'étanchéité périphérique entre la zone b de la tige 26 et la paroi de l'orifice central 36 du bouchon 35, lorsque ce dernier est engagé dans l'espace annulaire 22. L'élargissement 41 assure, jusqu'à la butée 27, le blocage du bouchon 30 sur la partie de tige c, en position éloignée de l'extrémité amont du corps souple 1 afin de ne pas gêner la transmission des sons extérieurs.

Le bouchon 35 est constitué à sa partie aval d'un corps cylindrique 37, de diamètre sensiblement égal ou à peine supérieur à celui de l'espace 22 pour assurer une obturation étanche, et il est surmonté à l'amont d'un plateau cylindrique 38, centré sur le corps 37 et de diamètre supérieur à ce dernier. Le plateau 38 sert de butée à l'enfoncement du bouchon 35 et contribue à assurer l'étanchéité périphérique entre le bouchon et la paroi intérieure 28 du corps souple 1.

Entre la butée 27 et la position d'obturation étanche dans laquelle le plateau 38 est en butée contre l'extrémité amont du corps souple 1, le bouchon 35 peut être déplacé sur la tige 26 au gré de l'utilisateur, pour atténuer plus ou moins les bruits extérieurs. La variante de réalisation selon la figure 4 offre ainsi des moyens d'atténuation additionnelle progressive entre le mode d'atténuation sélective et le mode d'atténuation maximale.

La protection auditive conforme à l'invention permet à l'utilisateur de sélectionner rapidement un mode de protection en fonction des conditions d'exposition. Elle est particulièrement bien adaptée aux contraintes opérationnelles rencontrées en environnement militaire, du fait des nombreux avantages qu'elle présente: légèreté, faible coût, robustesse, compatibilité avec d'autres équipements tels que

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casques, serre-têtes, masques...

Bien entendu, l'invention n'est pas limitée aux exemples de réalisation décrits et on peut apporter à ceux-ci de nombreuses modifications sans sortir du cadre de  
5 l'invention,

Ainsi, au lieu d'un orifice calibré unique, la cloison peut en comporter plusieurs, sous forme de trous ou de fentes dont la section sera d'autant plus réduite qu'ils seront plus nombreux.

10 L'obturateur permettant le fonctionnement en mode d'atténuation maximale pourrait être constitué par une valve rotative ou tout autre moyen permettant de couper la communication entre les deux extrémités du corps souple.

REVENDICATIONS

1. Protection auditive comprenant un corps souple  
5 allongé (1) destiné à venir en contact périphérique étanche  
avec les parois du conduit auditif (5), le corps souple (1)  
étant traversé axialement par un canal (2, 20) dans lequel  
est située une cloison transversale (11, 33) en contact  
périphérique étanche avec les parois du canal (2, 20),  
10 cette cloison (11, 23) présentant au moins une ouverture  
(12, 34) calibrée pour laisser passer une gamme de  
fréquences définie, tandis que la protection comporte des  
moyens d'atténuation sélective des sons extérieurs et des  
moyens d'atténuation maximale, non sélective, de ces sons,  
15 le mode de fonctionnement en atténuation sélective ou en  
atténuation maximale étant sélectionné à l'aide d'un  
obturateur à commande manuelle, caractérisée en ce que la  
cloison transversale (11, 33) est en un matériau plus  
rigide que celui du corps (1).

2. Protection auditive conforme à la revendication  
20 1, caractérisée en ce que la cloison (11, 33) a une  
épaisseur axiale comprise entre 0,1 et 5 mm et présente un  
ou plusieurs trous (12, 34) de diamètre compris entre 0,1  
et 0,7 mm.

25 3. Protection auditive conforme à l'une des  
revendications 1 ou 2, caractérisée en ce que la cloison  
transversale (11, 33) a un diamètre extérieur compris entre  
2 et 5 mm.

30 4. Protection auditive conforme à l'une des  
revendications 1 à 3, caractérisée en ce que le canal (2,  
20) est constitué de plusieurs tronçons de canal (7, 8 ;  
22, 23, 29, 31) assurant une transmission acoustique non  
linéaire.

35 5. Protection auditive conforme à la revendication  
4, caractérisée en ce que le canal (2, 20) comporte  
plusieurs tronçons de canal (7, 8 ; 22, 39, 31) coaxiaux au  
corps souple, le tronçon amont (7 ; 22, 29) débouchant par  
un épaulement annulaire (9 ; 25, 30) dans un tronçon aval  
(8 ; 29, 31) de section inférieure.

40 6. Protection auditive conforme à l'une des  
revendications 4 ou 5, caractérisée en ce que le canal (20)  
comporte des tronçons de canal (23) non coaxiaux au corps  
souple (1) débouchant à leur extrémité aval par un  
épaulement annulaire d'élargissement (32) dans un tronçon  
de canal (29) coaxial au corps souple (1).

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7. Protection auditive conforme à l'une des revendications 1 à 6, comportant un bouchon conçu pour s'engager de manière étanche dans l'extrémité amont du corps souple (1), caractérisée en ce que le bouchon (3) est relié à l'extrémité amont du corps souple (1) par un cordon (4) venu de matière.

8. Protection auditive conforme à la revendication 7, caractérisée en ce que le canal (2) est constitué de tronçons de canal (7, 8) dont le premier (7) à partir de l'extrémité amont débouche par un épaulement annulaire (9) dans un tronçon coaxial (8) de section inférieure, et en ce que ledit épaulement annulaire (9) constitue une butée à l'enfoncement du bouchon (3).

9. Protection auditive conforme à l'une des revendications 1 à 6, comportant un bouchon conçu pour s'engager de manière étanche dans l'extrémité amont du corps souple (1), caractérisée en ce que le bouchon (35) est monté coulissant le long d'une tige (26) qui est centrée à l'intérieur du corps souple (1) et en fait saillie du côté amont.

10. Protection auditive conforme à la revendication 9, caractérisée en ce que la tige (26) a une section (40) suffisamment large à l'intérieur du corps souple pour réaliser un contact étanche entre la tige (26) et le bouchon (35) lorsque ce dernier obture le corps souple (1).

11. Protection auditive conforme à l'une des revendications 9 ou 10, caractérisée en ce que la tige (26) comporte entre ses deux extrémités (24, 27) une zone (a) le long de laquelle le bouchon (35) coulisse librement, cette zone (a) étant comprise entre deux zones (b, c) le long desquelles le bouchon (35) coulisse avec friction.

12. Protection auditive conforme à l'une des revendications 1 à 11, caractérisée en ce que le corps souple (1) est tronconique et comporte sur sa surface extérieure des flasques souples (6) de diamètre croissant de l'extrémité aval à l'extrémité amont.

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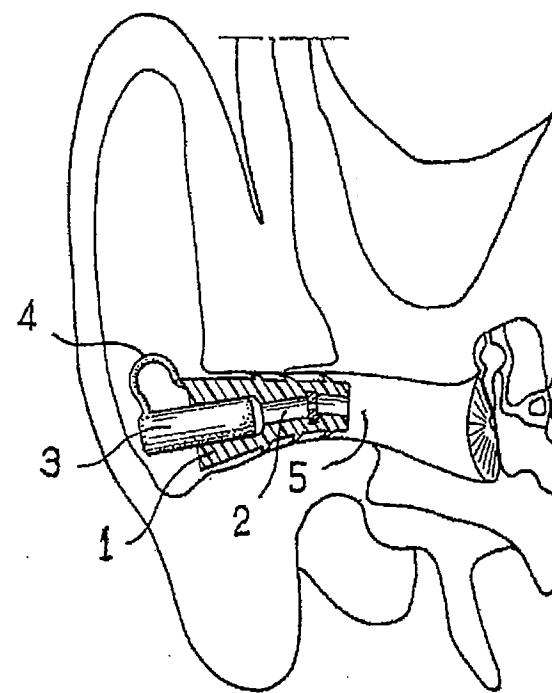


FIG. 1

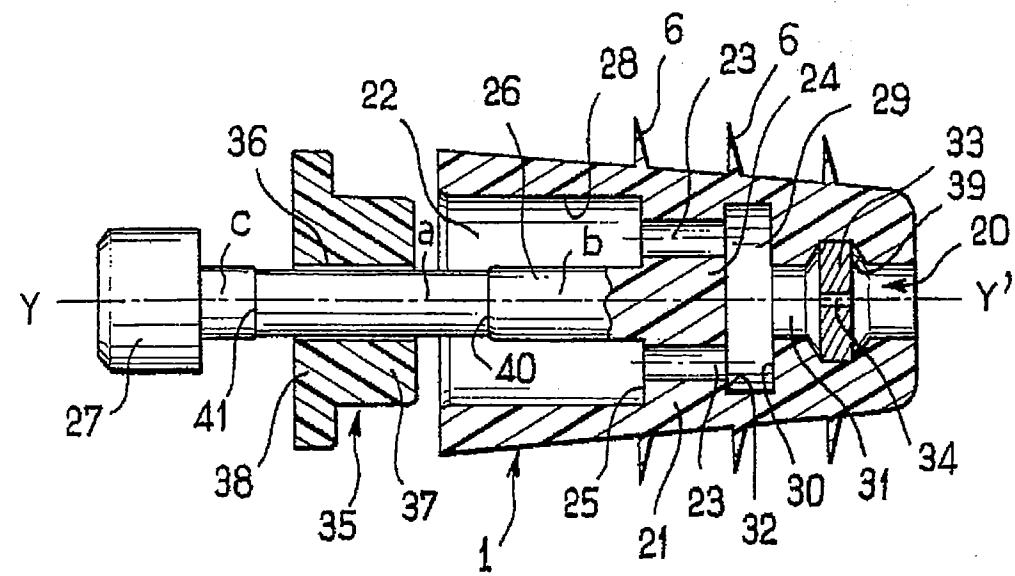


FIG. 4

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FIG. 2

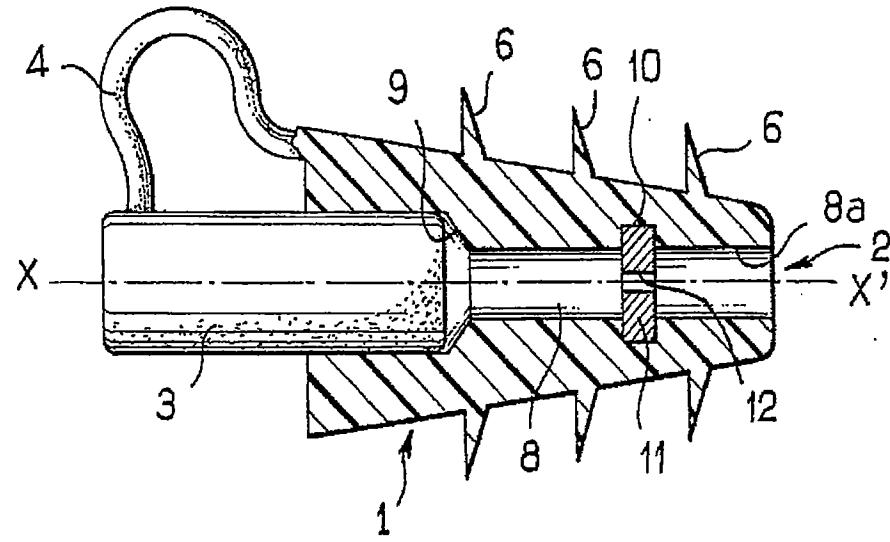
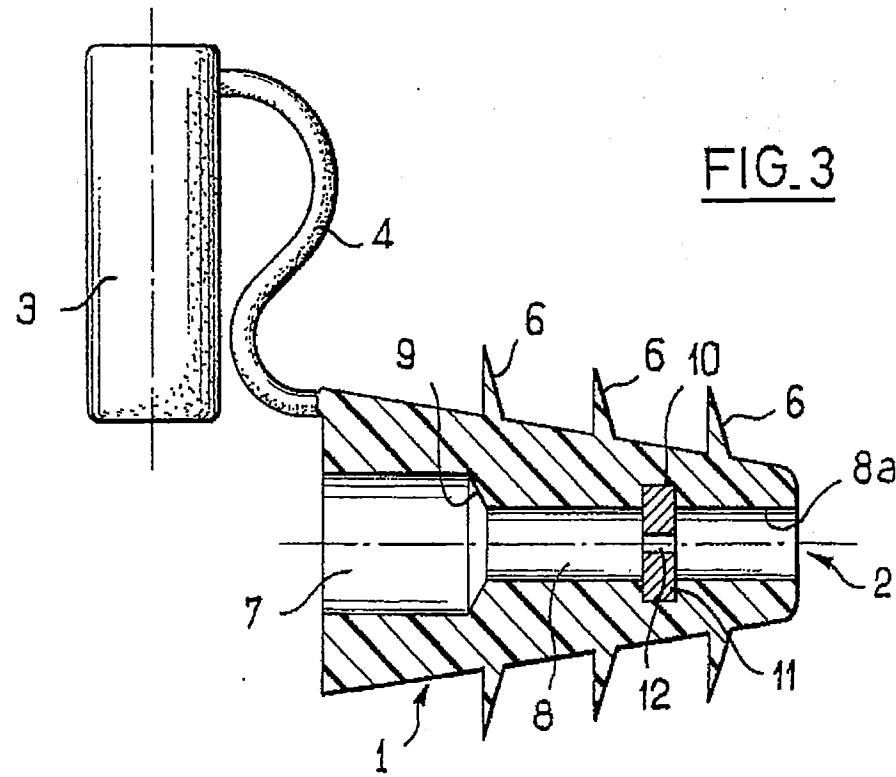


FIG. 3



# RAPPORT DE RECHERCHE

articles L.612-14, L.612-17 et R.612-53 à 69 du code de la propriété intellectuelle

## OBJET DU RAPPORT DE RECHERCHE

Après l'accomplissement de la procédure prévue par les textes rappelés ci-dessus, le brevet est délivré. L'Institut National de la Propriété Industrielle n'est pas habilité, sauf dans le cas d'absence manifeste de nouveauté, à en refuser la délivrance. La validité d'un brevet relève exclusivement de l'appréciation des tribunaux.

L'I.N.P.I. doit toutefois annexer à chaque brevet un "RAPPORT DE RECHERCHE" citant les éléments de l'état de la technique qui peuvent être pris en considération pour apprécier la brevetabilité de l'invention. Ce rapport porte sur les revendications figurant au brevet qui définissent l'objet de l'invention et délimitent l'étendue de la protection.

Après délivrance, l'I.N.P.I. peut, à la requête de toute personne intéressée, formuler un "AVIS DOCUMENTAIRE" sur la base des documents cités dans ce rapport de recherche et de tout autre document que le requérant souhaite voir prendre en considération.

## CONDITIONS D'ÉTABLISSEMENT DU PRÉSENT RAPPORT DE RECHERCHE

- Le demandeur a présenté des observations en réponse au rapport de recherche préliminaire.
- Le demandeur a maintenu les revendications.
- Le demandeur a modifié les revendications.
- Le demandeur a modifié la description pour en éliminer les éléments qui n' étaient plus en concordance avec les nouvelles revendications.
- Les tiers ont présenté des observations après publication du rapport de recherche préliminaire.
- Un rapport de recherche préliminaire complémentaire a été établi.

## DOCUMENTS CITÉS DANS LE PRÉSENT RAPPORT DE RECHERCHE

La répartition des documents entre les rubriques 1, 2 et 3 tient compte, le cas échéant, des revendications déposées en dernier lieu et/ou des observations présentées.

- Les documents énumérés à la rubrique 1 ci-après sont susceptibles d'être pris en considération pour apprécier la brevetabilité de l'invention.
- Les documents énumérés à la rubrique 2 ci-après illustrent l'arrière-plan technologique général.
- Les documents énumérés à la rubrique 3 ci-après ont été cités en cours de procédure, mais leur pertinence dépend de la validité des priorités revendiquées.
- Aucun document n'a été cité en cours de procédure.

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N° d'enregistrement national : 91 06150

N° de publication :

| 1.ELEMENTS DE L'ETAT DE LA TECHNIQUE SUSCEPTIBLES D'ETRE PRIS EN<br>CONSIDERATION POUR APPRECIER LA BREVETABILITE DE L'INVENTION |                                        |
|----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Référence des documents<br>(avec indication, le cas échéant, des parties pertinentes)                                            | Revendications du<br>brevet concernées |
| US - A - 4 353 364 (WOODS)<br>* colonne 4, ligne 30 - colonne 5, ligne 46; figures 4,6,7 *                                       | 1-7,12                                 |
| DE - A - 2 808 525 (KACO GMBH)<br>* page 7, ligne 5 - page 8, ligne 7; figure 1 *                                                | 12                                     |
| FR - A - 1 043 046 (ZWISLOCKI)<br>* page 2, colonne de gauche, alinéa 3 - colonne de droite *                                    | 1,2,12                                 |
| FR - A - 2 095 127 (SANTI LOUIS)<br>* page 1, ligne 33 - page 2, ligne 12; revendications 1,2;<br>figures 2,3 *                  | 1-5                                    |
| EP - A - 0 112 594 (DE BOER ET AL.)<br>* revendications; figures 1,2 *                                                           | 1-6                                    |
| US - A - 4 896 679 (ST. PIERRE)<br>* figure 7 *                                                                                  | 7                                      |
| US - A - 2 881 759 (HOCKS ET AL.)<br>* revendication 1; figures 2,3 *                                                            | 9-11                                   |
| 2.ELEMENTS DE L'ETAT DE LA TECHNIQUE ILLUSTRANT<br>L'ARRIERE-PLAN TECHNOLOGIQUE GENERAL                                          |                                        |
| US - A - 2 458 884 (VOLKMANN)                                                                                                    |                                        |
| 3. ELEMENTS DE L'ETAT DE LA TECHNIQUE DONT LA PERTINENCE<br>DEPEND DE LA VALIDITE DES PRIORITES                                  |                                        |
| Référence des documents<br>(avec indication, le cas échéant, des parties pertinentes)                                            | Revendications du<br>brevet concernées |
| NEANT                                                                                                                            |                                        |

# **EXHIBIT E**

JC541 U.S. PTO  
08/93-015  
12/18/97CASE 0:12-cv  
Subclass  
Class  
Issue Classification

5936208

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| UTILITY SERIAL NUMBER | PATENT DATE |          | PATENT NUMBER |
|                       | AUG 10 1998 |          | 5936208       |
| SERIAL NUMBER         | FILING DATE | CLAS8    | SUBCLASS      |
|                       |             |          | (125)         |
| GROUP ART UNIT        |             | EXAMINER |               |
| 11112                 |             |          |               |

APPLICANT

John W. Dang, Primary Examiner

Wm. W.

## \*\*FOREIGN APPLICATIONS\*\*\*\*\*

VERIFIED FRANCE

97,11623

09/18/97

Wm. W.

|                                                       |                                                                     |                     |                  |               |              |               |                     |                       |
|-------------------------------------------------------|---------------------------------------------------------------------|---------------------|------------------|---------------|--------------|---------------|---------------------|-----------------------|
| Foreign priority claimed<br>35 USC 119 conditions met | <input checked="" type="checkbox"/> yes <input type="checkbox"/> no | AS FILED            | STATE OR COUNTRY | Sheets DRWGS. | TOTAL CLAIMS | INDEP. CLAIMS | FILING FEE RECEIVED | ATTORNEY'S DOCKET NO. |
| Verified and Acknowledged                             | <input checked="" type="checkbox"/> yes <input type="checkbox"/> no | Examiner's Initials |                  |               |              |               |                     |                       |

ADDRESS

1000 University Street, Seattle, WA 98101

TITLE

John W. Dang, Primary Examiner

U.S. DEPT. OF COMM./PAT. &amp; TM--PTO-438L (Rev.12-94)

|                                                                                                                                                                                                                                                                                          |                       |                                       |                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------------------------------|------------------|
| PARTS OF APPLICATION FILED SEPARATELY                                                                                                                                                                                                                                                    |                       | John W. Dang<br>Applications Examiner |                  |
| NOTICE OF ALLOWANCE MAILED<br><br>12/16/99                                                                                                                                                                                                                                               |                       | CLAIMS ALLOWED                        |                  |
|                                                                                                                                                                                                                                                                                          |                       | Total Claims<br>15                    | Print Claim<br>1 |
| ISSUE FEE                                                                                                                                                                                                                                                                                |                       | DRAWING                               |                  |
| Amount Due<br>\$1,110.00                                                                                                                                                                                                                                                                 | Date Paid<br>12/16/99 | Sheets Drwg.<br>3                     | Figs. Drwg.<br>8 |
| Label Area                                                                                                                                                                                                                                                                               |                       | Print Fig.<br>6                       |                  |
|                                                                                                                                                                                                                                                                                          |                       | ISSUE BATCH NUMBER<br>D12             |                  |
| Primary Examiner<br>KURAN DANG<br>PRIMARY EXAMINER<br>GROUP 2100                                                                                                                                                                                                                         |                       |                                       |                  |
| PREPARED FOR ISSUE 12/16/99                                                                                                                                                                                                                                                              |                       |                                       |                  |
| WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code, Title 35, Sections 122, 181 and 368. Possession outside the U.S. Patent & trademark Office is restricted to authorized employees and contractors only. |                       |                                       |                  |

JG541 U.S. PTO

08/994015

12/16/97

# PATENT APPLICATION

APPROVED FOR LICENSE

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Date  
Entered  
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## CONTENTS

- |                          |   |            |            |
|--------------------------|---|------------|------------|
| 1. Application           | ✓ | papers.    | 6/24/98    |
| 2. Description           | ✓ | Drawings   | 9/8/98     |
| 3. Specification         | ✓ |            | 10/6/98    |
| 4. Figures with drawings | ✓ |            | 10/6/98    |
| 5. Claims                | ✓ |            | 10/20/98   |
| 6. Kff. 3                | ✓ |            | 10/20/98   |
| 7. Format A              | ✓ |            | 10/20/98   |
| 8. Notice of Allowance   | ✓ |            | 2/16/99 MP |
| 9. Formal Drawings       | ✓ | Initials L | 4/1/99     |
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**SEARCHED**

| Class                 | Sub.         | Date     | Exmr. |
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| 161                   | 136<br>135   | 10/10/98 | KD    |
| 128                   | § 64<br>§ 61 |          |       |
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| Above search updated. |              | 2/12/99  | KD    |
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**SEARCH NOTES**

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**INTERFERENCE SEARCHED**

| Class | Sub. | Date    | Exmr. |
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| 161   | 135  | 2/12/99 | KD    |

STAPLE AREA

U.S. GOVERNMENT PRINTING OFFICE 1938-140-7

PATENT NUMBER

APPLICATION SERIAL NUMBER

081994,015

APPLICANT'S NAME (PLEASE PRINT)

HAMERY

IF REISSUE, ORIGINAL PATENT NUMBER

INTERNATIONAL CLASSIFICATION

A 61 B 7 / 62

## ORIGINAL CLASSIFICATION

| CLASS | SUBCLASS |
|-------|----------|
| 181   | 135      |

## CROSS REFERENCE(S)

CLASS                            SUBCLASS  
(ONE SUBCLASS PER BLOCK)

GROUP ART UNIT

ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME)

2837 Khanh Dang

U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICEPTO-270  
(REV. 5-91)

## ISSUE CLASSIFICATION SLIP

| Claim | Original | Date |
|-------|----------|------|
| 1     | 1        | ✓    |
| 2     | 3        | 0    |
| 3     | 4        | ✓    |
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## SYMBOLS

- ✓ ... Rejected
- ✗ ... Allowed
- (Through number) ... Cancelled
- + ... Restricted
- N ... Non-elected
- ... Interference
- A ... Appeal
- O ... Objected

PATENT APPLICATION SERIAL NO. \_\_\_\_\_

U.S. DEPARTMENT OF COMMERCE  
PATENT AND TRADEMARK OFFICE  
FEE RECORD SHEET

02/11/1998 RPERRY 00000024 08994015  
01 FC:101 750.00 OP  
02 FC:103 286.00 OP

NONPROV. FINAL PATENT APPLICATION A

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400  
Facsimile: (703) 836-2787

Attorney Docket No.: WPB 40126

Date: December 18, 1997

PTO  
18/97

BOX PATENT APPLICATION

NONPROVISIONAL APPLICATION TRANSMITTAL  
RULE §1.53(b)

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 C.F.R. §1.53(b) is the nonprovisional patent application

For (Title): HEARING PROTECTOR AGAINST LOUD NOISE

By (Inventors): Pascal HAMERY

- Formal drawings (Figs. 1-6; 3 sheets) are attached.  
 A Declaration and Power of Attorney is filed herewith.  
 An assignment of the invention to Institut Franco - Allemand de Recherches de Saint-Louis is filed herewith.  
 An Information Disclosure Statement is filed herewith.  
 A statement to establish small entity status under 37 C.F.R. §§1.9 and 1.27 is filed herewith.  
 A Preliminary Amendment is filed herewith.  
 Please amend the specification by inserting before the first line the sentence --This nonprovisional application claims the benefit of U.S. Provisional Application No. \_\_\_\_\_, filed \_\_\_\_\_.  
 Priority of foreign application No. 97.11623 filed September 18, 1997 in France is claimed under 35 U.S.C. §119.  
 A certified copy of the above corresponding foreign application(s) is filed herewith.  
 The filing fee is calculated below:

CLAIMS IN THE APPLICATION AFTER ENTRY OF  
ANY PRELIMINARY AMENDMENT NOTED ABOVE

| FOR:                                                         | NO. FILED | NO. EXTRA |
|--------------------------------------------------------------|-----------|-----------|
| BASIC FEE                                                    |           |           |
| TOTAL CLAIMS                                                 | 33 - 20   | = 13      |
| INDEP CLAIMS                                                 | 2 - 3     | = 0       |
| <input type="checkbox"/> MULTIPLE DEPENDENT CLAIMS PRESENTED |           |           |

\* If the difference is less than zero, enter "0".

SMALL ENTITY

| RATE   | FEE    |
|--------|--------|
|        | \$ 395 |
| x 11 = | \$     |
| x 41 = | \$     |
| +135 = | \$     |
| TOTAL  | \$     |

OTHER THAN A  
SMALL ENTITY

| RATE   | FEE     |
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|        | \$ 790  |
| x 22 = | \$ 286  |
| x 82 = | \$ 0    |
| +270 = | \$ 0    |
| TOTAL  | \$ 1076 |

- Check No. 57053 in the amount of \$1,076.00 to cover the filing fee is attached. The Commissioner is hereby authorized to charge any other fees that may be required to complete this filing, or to credit any overpayment, to Deposit Account No. 15-0461. Two duplicate copies of this sheet are attached.

Respectfully submitted,

  
William P. Berridge  
Registration No. 30,024

Stephen P. Catlin  
Registration No. 36,101

DEPOSIT ACCOUNT USE  
AUTHORIZATION  
Please grant any extension  
necessary for entry;  
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Deposit Account No. 15-0461

WPB:SPC/kc

## HEARING PROTECTOR AGAINST LOUD NOISE

### BACKGROUND OF THE INVENTION

#### 1. Field of Invention

The invention relates to hearing protectors, and in particular, the invention  
5 relates to a hearing protector to protect against high, continuous or impulsive, noises.  
The hearing protector can function either in a selective attenuation mode or a maximum attenuation mode.

#### 2. Description of Related Art

In the selective attenuation mode, sound attenuation is low for a specific  
10 range of frequencies and increases for sounds with frequencies above those in the specified range. Selective attenuation is especially effective for the loudest noises. A sample application of a hearing protector operating in the selective attenuation mode is the intelligible speech transmission in a noisy environment caused by impulsive noises, such as gunshots, for example. In this case, the frequency range in which the  
15 attenuation is low is between 100Hz to 1000 Hz. In the maximum attenuation mode, the hearing protector stops all sounds throughout the frequency range, regardless of their intensity.

French Patent Publication No. 2 676 642, filed in the name of the Applicant, discloses a hearing protector that is not cumbersome and contacts the auditory canal. The protector comprises an elongate flexible body containing selective attenuation means, maximum attenuation means, and a manually controlled plug that makes it possible to choose the attenuation functional mode to be either selective or maximum. However, this device requires careful handling by the user who wants to block the auditory canal himself. This manipulation can be done incorrectly, resulting  
25 in inefficient blockage in the selective or maximum attenuation modes.

### SUMMARY OF THE INVENTION

The goal of the present invention is to provide a reliable hearing protector that does not suffer from the disadvantage of user adjustment and permits two configurations for noise attenuation that have different characteristics.

Another goal of the present invention is to provide a reliable hearing protector capable of selectively or automatically attenuating noises having intensities up to 190 dB. The hearing protector is intended to be sealingly inserted into the auditory canal of the user. The hearing protector includes a flexible cylindrical body having a

ferrule at each end, with at least one of the ferrules having a channel that runs from one end of the ferrule to the center of the body and contains an acoustic filter.

The hearing protector has two ends, both of which can be inserted into the auditory canal and is referred to as a "double-ended" device. This contrasts with the 5 well-known hearing protector that typically has one end that can be inserted into the auditory canal, while the other end allows the hearing protector to be gripped so the user can position it in the auditory canal. The present invention has two ends, that may or may not be identical, either of which can be inserted into the auditory canal, thus making it possible to choose between two operating modes of attenuation that 10 may or may not be identical.

The device is useful in the fact that it possesses, in the same hearing 15 protector, two configurations that can have different attenuation characteristics, both obtained by simply reversing the direction of the hearing protector, or ear plug, that is inserted into the auditory canal.

In a preferred embodiment, the two ferrules are separate parts linked by an 20 internal connector. The internal connector may be a single cylinder pierced by a channel containing an acoustic filter, the cylinder forming a right angle that terminates at a first end of the channel and a second end at the center of the connector.

The internal connector may also be a single cylinder having a channel that 25 terminates at three locations, such as at the center of the connector or at each end of the connector, with the parts of the channel terminating at the ends containing an acoustic filter that may or may not be identical.

The internal connector may also be composed of three cylindrical parts. The central part may have a channel at its center with a diameter slightly greater than 30 that of the other two parts. The other two parts have a diameter that is essentially equal to or slightly larger than that of the channel. At least one of the two parts is pierced by a channel at its center which contains an acoustic filter and communicates with the channel in the central part. When the two parts each contain an acoustic filter, the filters may or may not be identical.

In an alternate embodiment, the internal connector may have serrations, or ridges, to hold the ferrules in place while in the auditory canal.

In yet another embodiment, the hearing protector may have tapered ends.

Preferably, each ferrule of the hearing protector is provided with an essentially hemispherical face of which the narrower side is intended to be inserted first into the auditory canal.

Advantageously, the body of the hearing protector may be provided with flexible annular fins having a diameter that increases from the inside to the outside of the auditory canal in order to wedgingly secure it in the auditory canal.

The hearing protector makes it possible to perform nonlinear sound filtration by choosing the correct acoustic filter.

#### BRIEF DESCRIPTION OF THE DRAWINGS

10 The invention will be described in conjunction with the following drawings in which like reference numerals designate like elements and wherein:

✓ Figure 1 is a longitudinal view, in partial section, of a "double-ended" hearing protector according to a preferred embodiment of the present invention;

15 ✓ Figure 2 is a longitudinal section view of a "double-ended" hearing protector according to a second embodiment of the present invention;

✓ Figure 3 is a longitudinal section view of a "double-ended" hearing protector according to a third embodiment of the present invention;

20 ✓ Figure 4a-4c are longitudinal views, in partial section, of different configurations of the internal connector that join the two ends of the hearing protector according to the present invention;

✓ Figure 5 is a perspective view of an internal connector for the two ends of the hearing protector according to an embodiment of the present invention;

✓ Figure 6 is a longitudinal view, in partial section, of a hearing protector according to a fourth embodiment of the present invention.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Figure 1 is a longitudinal view, in partial section, of the hearing protector according to one preferred embodiment of the present invention. The hearing protector includes a body 1 that is molded to fit in the auditory canal of the user. The body 1 is pierced by a channel 2 that runs from an end of the body 1 and terminates in the center of the body 1. The channel 2 contains an acoustic filter 3 that allows for example the selective and nonlinear filtration of sound. The other end of the body 1 is not perforated and allows maximum attenuation, regardless of the frequency and amplitude of the sound. Ideally, the body 1 has a length between 2 cm and 4 cm and is composed of a flexible material.

Figure 2 is a longitudinal section view of the hearing protector according to a second embodiment of the present invention. The hearing protector includes a body 1 pierced by a channel 2 that terminates at each end of the body 1, as well as the center of body 1. The channel 2 also contains an acoustic filter 3 at each end. The filters may or may not be identical.

Referring to a third embodiment illustrated in Figure 3, the hearing protector includes two cylindrical hollow ferrules 4 and 7 and an internal connector 8. The ferrules 4 and 7 are separate pieces that fit into one another and are joined by the internal connector 8 to keep the ferrules 4 and 7 together. Each ferrule 4 and 7 is provided with a substantially hemispherical face 6. The narrower portion of the face 6 is designed to be inserted first into the auditory canal. The substantially hemispherical face 6 ensures tightness between the hearing protector and the auditory canal. As illustrated in Figure 3, at least one of the two ferrules, in this case, ferrule 4, is pierced by a channel 5 at its center. One of the two ends of the internal connector 8 that contains an acoustic filter 3 is inserted into at least one of the two ferrules 4 and 7. The acoustic filter 3 permits the selective non-linear filtration of sounds. The second ferrule, in this case, ferrule 7, need not be perforated and will allow maximum attenuation regardless of the frequency and amplitude of the sound. The internal connector 8 is pierced by a second channel 9 that connects at a first end with the first channel 5, which contains an acoustic filter 3, allowing for the use of the acoustic filter 3, and at a second end with the center of the connector 8. The second channel 9 is formed at a right angle to the channel 5.

Alternatively, in another embodiment, the internal connector 8 may also have a channel that extends in three locations, the center of the internal connector 8, as well as at each end of the internal connector 8. The portion of the channel that terminates at each end contains an acoustic filter 3 that may or may not be identical.

As shown in Figure 4a, the internal connector 8 may include a single cylinder consisting of three cylindrical parts 10, 11, and 12. The central part 12 is pierced by a channel 9 at its center and has a diameter that is slightly larger than that of the other two parts 10 and 11. The two parts 10 and 11 have a diameter that is essentially equal to, but slightly larger than that of channel 5 in order to hold the assembly together. At least one of the two parts 10 and 11 is formed with channel 5, which contains an acoustic filter 3 and communicates with channel 9 in the central part 12, as shown in Figure 5.

The internal connector 8 may have serrations, or ridges, as shown in Figures 4b and 6, or the internal connector 8 may have tapered ends 13 and 14, as shown in Figures 4c and 5. In the case when the internal connector 8 is in three parts, the two parts 10 and 11 will have the serrations, ridges, or tapered ends 13 and 14.

5 One of the two ferrules has a perforation that, when joined to connector 8, is aligned with that of the central end of channel 9 located in part 12.

10 Figure 6 is a longitudinal view, in partial section, of the hearing protector according to a fourth embodiment of the present invention. The hearing protector is provided with flexible annular fins 15 on the ferrules 4 and 7 to wedge the hearing protector against the walls of the auditory canal. The fins 15 may have a diameter that increases from the inside to the outside of the auditory canal.

15 The hearing protector, according to the present invention, is especially useful for individuals who are exposed to very loud engine and weapon noises, such as the crews of airplanes or military vehicles on exercises, for example. The hearing protector, according to the present invention, can also be used effectively by other personnel exposed to high-intensity noises in their working environments, such as construction sites and quarries for example.

20 While this invention has been described in conjunction with specific embodiments thereof, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art. Accordingly, the preferred embodiments of the invention as set forth herein are intended to be illustrative, not limiting. Various changes may be made without departing from the spirit and scope of the invention as defined in the following claims.

WHAT IS CLAIMED IS:

1. A hearing protector capable of selectively or automatically attenuating noises having intensities up to 190 dB, the hearing protector being intended to be sealingly inserted into an auditory canal of a user, the hearing protector comprising:

a cylindrical body having a center, a first end and a second end;

a channel extending from at least one of said first and said second ends of said body to said center of said body; and

said channel contains an acoustic filter.

2. The hearing protector according to claim 1, further having a ferrule at each of said first and said second ends, wherein said ferrules are separate and said cylindrical body forms an internal connector linking said ferrules.

2. The hearing protector according to claim 2, wherein said internal connector is a single cylinder, said channel forming a right angle and having a first end of said channel containing said acoustic filter and terminating at at least one of said ferrules and a second end of said channel terminating in said center of said internal connector.

3. The hearing protector according to claim 2, wherein said channel in said internal connector terminates at said center of said internal connector and at said first end and said second end of said internal connector, said first end containing said acoustic filter and said second end containing a second acoustic filter.

4. The hearing protector according to claim 3, wherein said acoustic filter is identical to said second acoustic filter.

5. The hearing protector according to claim 3, wherein said acoustic filter is not identical to said second acoustic filter.

6. The hearing protector according to claim 2, wherein said internal connector includes a central cylindrical part having a central diameter, a first cylindrical part having a first diameter and containing said acoustic filter and a second cylindrical part having a second diameter, said central diameter being larger than said first diameter and said second diameter, said first diameter and said second diameter being larger than said channel.

7. The hearing protector according to claim 6, wherein said second cylindrical part contains said second acoustic filter.

8. The hearing protector according to claim 6, wherein said acoustic filter and said second acoustic filter are identical.

9 ~~10.~~ The hearing protector according to claim ~~6~~, wherein said acoustic filter and said second acoustic filter are not identical.

10 ~~11.~~ The hearing protector according to claim ~~2~~, wherein said internal connector has serrations for securing said ferrules to said internal connector.

11 ~~12.~~ The hearing protector according to claim ~~2~~, wherein said internal connector has ridges for securing said ferrules to said internal connector.

12 ~~13.~~ The hearing protector according to claim ~~2~~, wherein said internal connector has tapered ends.

13 ~~14.~~ The hearing protector according to claim ~~2~~, wherein said ferrules each have an essentially hemispherical face having a narrow side, said narrow sides being designed to be inserted into the auditory canal of the user first.

14 ~~15.~~ The hearing protector of claim 1, wherein said cylindrical body is provided with annular fins, said fins having a diameter that increases from said first and second ends of said cylindrical body toward said center of said cylindrical body, the hearing protector being wedgily securable within the auditory canal of the user.

15 ~~16.~~ The hearing protector according to claim 1, wherein said acoustic filter permits non-linear filtration of sound.

17. A hearing protector for selectively or automatically reducing noises having intensities up to 190 dB, the hearing protector being intended to be sealingly inserted into an auditory canal of a user, the hearing protector comprising:

a cylindrical body having a center, a first end and a second end;  
a channel extending from said first and second ends to said center of said cylindrical body; and

said channel containing a first acoustic filter and a second acoustic filter, each of said first and second filters being in communication with one of said first and second ends.

18. The hearing protector according to claim 17, wherein said first and second acoustic filters are identical.

19. The hearing protector according to claim 17, wherein said first and second acoustic filters are not identical.

20. The hearing protector according to claim 17, further having a ferrule at each of said first and second ends wherein said ferrules are separate and said cylindrical body forms an internal connector linking said ferrules.

21. The hearing protector according to claim 20, wherein said internal connector is a single cylinder, said channel forming a right angle and having a first end of said channel containing said first acoustic filter and terminating at at least one of said ferrules and a second end of said channel terminating in said center of said internal connector.

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22. The hearing protector according to claim 20, wherein said channel in said internal connector terminates at said center of said internal connector and at said first end and said second end of said internal connector, said first end containing said first acoustic filter and said second end containing said second acoustic filter.

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23. The hearing protector according to claim 22, wherein said first acoustic filter is identical to said second acoustic filter.

24. The hearing protector according to claim 22, wherein said first acoustic filter is not identical to said second acoustic filter.

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25. The hearing protector according to claim 20, wherein said internal connector includes a central cylindrical part having a central diameter, a first cylindrical part having a first diameter and a second cylindrical part having a second diameter, said central diameter being larger than said first diameter and said second diameter, said first diameter and said second diameter being larger than said channel, said first cylindrical part containing said first acoustic filter and said second cylindrical part contains said second acoustic filter.

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26. The hearing protector according to claim 25, wherein said first acoustic filter and said second acoustic filter are identical.

27. The hearing protector according to claim 25, wherein said first acoustic filter and said second acoustic filter are not identical.

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28. The hearing protector according to claim 20, wherein said internal connector has serrations for securing said ferrules to said internal connector.

29. The hearing protector according to claim 20, wherein said internal connector has ridges for securing said ferrules to said internal connector.

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30. The hearing protector according to claim 20, wherein said internal connector has tapered ends.

31. The hearing protector according to claim 17, wherein said ferrules each have an essentially hemispherical face having a narrow side, said narrow sides being designed to be inserted into the auditory canal of the user first.

9

32. The hearing protector of claim 17, wherein said cylindrical body is provided with annular fins, said fins having a diameter that increases from said first and second ends of said cylindrical body toward said center of said cylindrical body, the hearing protector being wedgingly securable within the auditory canal of the user.

5

33. The hearing protector according to claim 17, wherein said acoustic filters permit non-linear filtration of sound.

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U.S. DISTRICT COURT  
MAY 2013

081994015

ABSTRACT OF THE DISCLOSURE

The invention relates to a hearing protector for attenuating, selectively or not, noises that can have an intensity of up to 190 dB, designed to be inserted in sealing fashion into the auditory canal. The hearing protector includes a flexible cylindrical body that has a ferrule at each end. At least one of the two ferrules has a channel that runs from one end of the ferrule to the center of the cylindrical body and contains an acoustic filter. When the two ferrules each contain an acoustic filter, the filters may or may not be identical.

SEARCHED INDEXED  
SERIALIZED FILED

Docket No.: WPB 40126

A. APPLICATION FOR UNITED STATES PATENT  
DECLARATION AND POWER OF ATTORNEY

As a below named Inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; that

I verify believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: HEARING PROTECTOR AGAINST LOUD NOISE

described and claimed in the specification:

Check one

- a.  attached hereto.  
b.  filed on \_\_\_\_\_ as Application No. \_\_\_\_\_ and amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in Title 35, Code of Federal Regulations, §1.56.

Under Title 35, U.S. Code §119, the priority benefits of the following foreign application(s) and/or United States provisional application(s) filed within one year prior to this application are hereby claimed:

French Patent Application No. 97,11623 filed on September 18, 1997

The following application(s) for patent or Inventor's certificate on this invention were filed in countries foreign to the United States of America either (a) more than one year prior to this application, or (b) before the filing date of the above-named foreign priority application(s) and/or United States provisional application(s):

I hereby appoint the following as my attorneys of record with full power of substitution and revocation to prosecute this application and to transact all business in the Patent Office:

James A. Oliff, Reg. No. 27,075; William P. Berridge, Reg. No. 30,024;  
Kirk M. Hudson, Reg. No. 27,562; Thomas J. Pardini, Reg. No. 30,411;  
Edward F. Walker, Reg. No. 31,450; Robert A. Miller, Registration No. 32,771 and  
Mario A. Costantino, Registration No. 33,565.

ALL CORRESPONDENCE IN CONNECTION WITH THIS APPLICATION SHOULD BE SENT TO OLIFF & BERRIDGE, PLC, P.O. BOX 19928, ALEXANDRIA, VIRGINIA 22320, TELEPHONE (703) 836-6400.

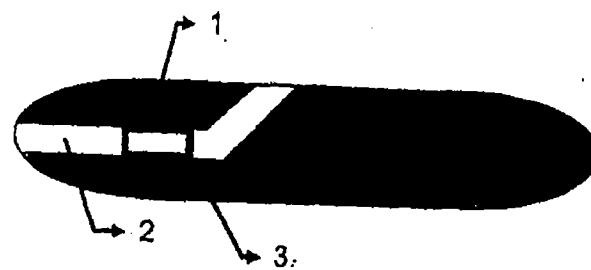
I hereby declare that I have reviewed and understand the contents of this Declaration, and that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

|   |                                                                                    |                                             |                   |             |
|---|------------------------------------------------------------------------------------|---------------------------------------------|-------------------|-------------|
| 1 | Typewritten Full Name<br>of First or Sole Inventor                                 | Pascal                                      | HAMERY            |             |
| 2 | **Inventor's Signature:                                                            | Given Name                                  | Middle Initial    | Family Name |
| 3 | **Date of Signature:                                                               | Signature: Pascal HAMERY<br>8 December 1997 |                   |             |
|   | Residence:                                                                         | Month                                       | Day               | Year        |
|   | Mulhouse                                                                           |                                             |                   | FRANCE      |
|   | Citizenship:                                                                       | City                                        | State or Province | Country     |
|   | FRENCH                                                                             |                                             |                   |             |
|   | Post Office Address:<br>(Insert complete<br>mailing address,<br>including country) | 7, rue de Verdun<br>68100 Mulhouse, FRANCE  |                   |             |

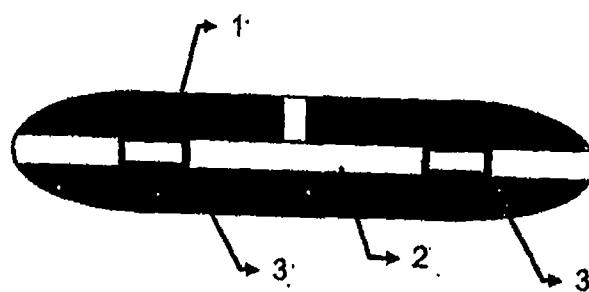
\*If Box (a.) is checked, this form may be executed only when attached to the specification (including claims).

\*\*Note to Inventor: Please sign name exactly as it appears above and insert actual date of signing.

IF THERE IS MORE THAN ONE INVENTOR USE PAGE 2 AND PLACE AN "X" HERE

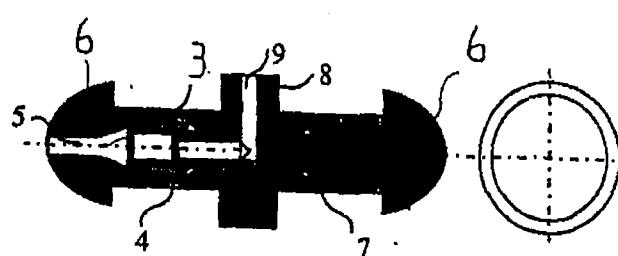


**Figure 1**

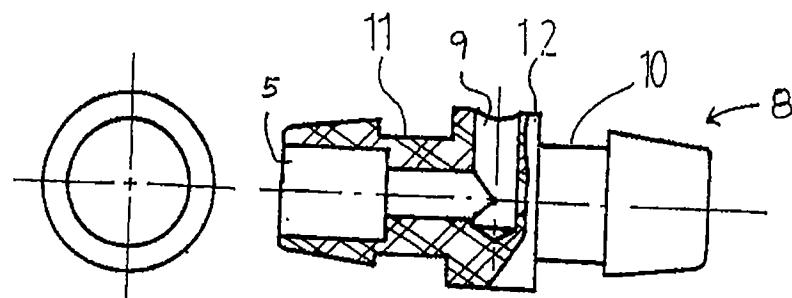


**Figure 2**

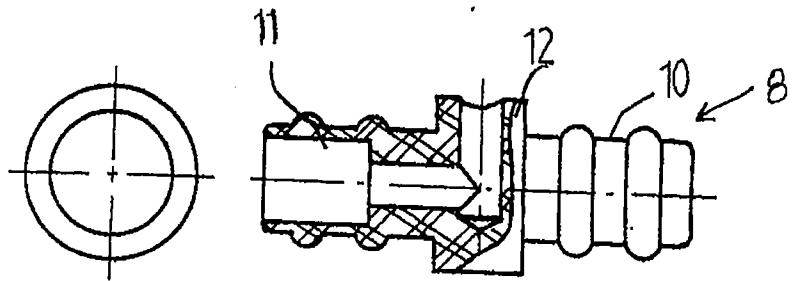
PRINT OF DRAWINGS  
AS ORIGINALLY FILED



**Figure 3**

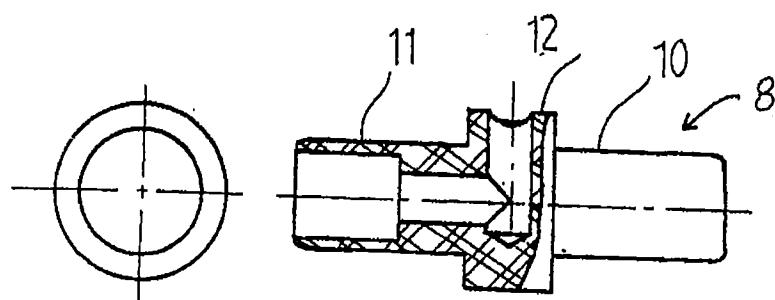


**Figure 4c**

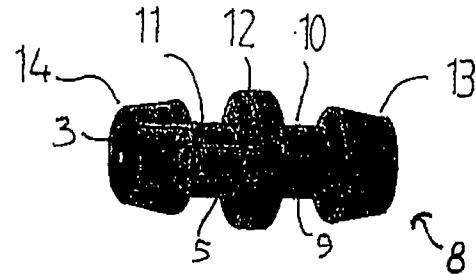


**Figure 4b**

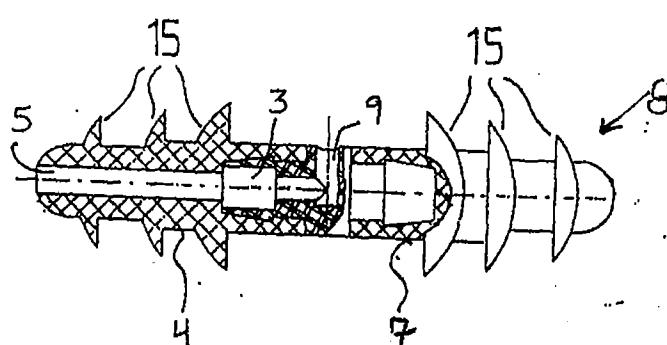
PRINT OF DRAWINGS  
AS ORIGINALLY FILED



**Figure 4a**



**Figure 5**



PRINT OF DRAWINGS  
AS ORIGINALLY FILED

**Figure 6**

| PATENT APPLICATION FEE DETERMINATION RECORD                                                                                                                                                                                                                                                                                                                                                                                                |                                  |                                    |               |        | Application or Docket Number                                                                 |                     |                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------|---------------|--------|----------------------------------------------------------------------------------------------|---------------------|----------------|
| Effective November 10, 1998                                                                                                                                                                                                                                                                                                                                                                                                                |                                  |                                    |               |        |                                                                                              |                     |                |
| <b>CLAIMS AS FILED - PART I</b>                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                    |               |        | <b>SMALL ENTITY</b>                                                                          |                     |                |
| (Column 1) (Column 2)                                                                                                                                                                                                                                                                                                                                                                                                                      |                                  |                                    |               |        | TYPE <input type="checkbox"/> OR <input checked="" type="checkbox"/> OTHER THAN SMALL ENTITY |                     |                |
| FOR                                                                                                                                                                                                                                                                                                                                                                                                                                        | NUMBER FILED                     | NUMBER EXTRA                       | RATE          | FEES   | RATE                                                                                         | FEES                |                |
| BASIC FEE                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                                    |               | 360.00 |                                                                                              | 760.00              |                |
| TOTAL CLAIMS                                                                                                                                                                                                                                                                                                                                                                                                                               | minus 20 = *                     |                                    | X\$ 9=        |        | X\$18=                                                                                       |                     |                |
| INDEPENDENT CLAIMS                                                                                                                                                                                                                                                                                                                                                                                                                         | minus 3 = *                      |                                    | X39=          |        | X78=                                                                                         |                     |                |
| MULTIPLE DEPENDENT CLAIM PRESENT                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                                    |               |        | +130=                                                                                        | +260=               |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                    |               |        | TOTAL                                                                                        | OR TOTAL            |                |
| * If the difference in column 1 is less than zero, enter "0" in column 2                                                                                                                                                                                                                                                                                                                                                                   |                                  |                                    |               |        |                                                                                              |                     |                |
| <b>CLAIMS AS AMENDED - PART II</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                  |                                    |               |        | <b>SMALL ENTITY</b>                                                                          | <b>OTHER THAN</b>   |                |
| (Column 1) (Column 2) (Column 3)                                                                                                                                                                                                                                                                                                                                                                                                           |                                  |                                    |               |        | OR                                                                                           | SMALL ENTITY        |                |
| <b>AMENDMENT A</b>                                                                                                                                                                                                                                                                                                                                                                                                                         | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE   | ADDITIONAL FEE                                                                               | RATE                | ADDITIONAL FEE |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            | Total * 15 Minus ** 33 =         |                                    |               | X\$ 9= |                                                                                              | X\$18=              |                |
| Independent * 1 Minus *** 3 =                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |                                    | X39=          |        | X78=                                                                                         |                     |                |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                                    |               |        | +130=                                                                                        | +260=               |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                    |               |        | TOTAL ADDIT. FEE                                                                             | OR TOTAL ADDIT. FEE |                |
| <b>AMENDMENT B</b>                                                                                                                                                                                                                                                                                                                                                                                                                         | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE   | ADDITIONAL FEE                                                                               | RATE                | ADDITIONAL FEE |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            | Total * Minus ** =               |                                    |               | X\$ 9= |                                                                                              | X\$18=              |                |
| Independent * Minus *** =                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                                    | X39=          |        | X78=                                                                                         |                     |                |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                                    |               |        | +130=                                                                                        | +260=               |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                    |               |        | TOTAL ADDIT. FEE                                                                             | OR TOTAL ADDIT. FEE |                |
| <b>AMENDMENT C</b>                                                                                                                                                                                                                                                                                                                                                                                                                         | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA | RATE   | ADDITIONAL FEE                                                                               | RATE                | ADDITIONAL FEE |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            | Total * Minus ** =               |                                    |               | X\$ 9= |                                                                                              | X\$18=              |                |
| Independent * Minus *** =                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |                                    | X39=          |        | X78=                                                                                         |                     |                |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                                                                                                                                                                                                                                                                                                                                                                                             |                                  |                                    |               |        | +130=                                                                                        | +260=               |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                  |                                    |               |        | TOTAL ADDIT. FEE                                                                             | OR TOTAL ADDIT. FEE |                |
| <p>* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.<br/>     ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."<br/>     *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."<br/>     The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.</p> |                                  |                                    |               |        |                                                                                              |                     |                |

| PATENT APPLICATION FEE DETERMINATION RECORD                              |                                  |                                    |                   |                         | Application or Docket Number<br><i>994 015</i> |                |
|--------------------------------------------------------------------------|----------------------------------|------------------------------------|-------------------|-------------------------|------------------------------------------------|----------------|
| Effective October 1, 1997                                                |                                  |                                    |                   |                         |                                                |                |
| CLAIMS AS FILED - PART I                                                 |                                  |                                    |                   |                         |                                                |                |
| (Column 1)                                                               |                                  |                                    | (Column 2)        |                         |                                                |                |
| FOR                                                                      | NUMBER FILED                     | NUMBER EXTRA                       | SMALL ENTITY TYPE | OTHER THAN SMALL ENTITY |                                                |                |
| BASIC FEE                                                                |                                  |                                    |                   |                         |                                                |                |
| TOTAL CLAIMS                                                             | <i>33</i>                        | minus 20 = * <i>13</i>             | x\$11=            | 790.00                  |                                                |                |
| INDEPENDENT CLAIMS                                                       | <i>2</i>                         | minus 3 = * <i>0</i>               | x41=              |                         |                                                |                |
| MULTIPLE DEPENDENT CLAIM PRESENT                                         |                                  |                                    |                   |                         |                                                |                |
| * If the difference in column 1 is less than zero, enter "0" in column 2 |                                  |                                    |                   |                         |                                                |                |
|                                                                          |                                  |                                    |                   |                         | RATE      FEE                                  |                |
|                                                                          |                                  |                                    |                   |                         | +135=                                          |                |
|                                                                          |                                  |                                    |                   |                         | TOTAL                                          | <i>1676.00</i> |
| CLAIMS AS AMENDED - PART II                                              |                                  |                                    |                   |                         |                                                |                |
| (Column 1)                                                               |                                  |                                    | (Column 2)        | (Column 3)              |                                                |                |
| AMENDMENT A                                                              | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA     | SMALL ENTITY            | OTHER THAN SMALL ENTITY                        |                |
|                                                                          | Total                            | *                                  | Minus             | **                      | =                                              | x\$11=         |
|                                                                          | Independent                      | *                                  | Minus             | ***                     | =                                              | x41=           |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                           |                                  |                                    |                   |                         | +135=                                          |                |
|                                                                          |                                  |                                    |                   |                         | TOTAL ADDIT. FEE                               |                |
| AMENDMENT B                                                              | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA     | RATE ADDITIONAL FEE     | RATE ADDITIONAL FEE                            |                |
|                                                                          | Total                            | *                                  | Minus             | **                      | =                                              | x\$11=         |
|                                                                          | Independent                      | *                                  | Minus             | ***                     | =                                              | x41=           |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                           |                                  |                                    |                   |                         | +135=                                          |                |
|                                                                          |                                  |                                    |                   |                         | TOTAL ADDIT. FEE                               |                |
| AMENDMENT C                                                              | CLAIMS REMAINING AFTER AMENDMENT | HIGHEST NUMBER PREVIOUSLY PAID FOR | PRESENT EXTRA     | RATE ADDITIONAL FEE     | RATE ADDITIONAL FEE                            |                |
|                                                                          | Total                            | *                                  | Minus             | **                      | =                                              | x\$11=         |
|                                                                          | Independent                      | *                                  | Minus             | ***                     | =                                              | x41=           |
| FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM                           |                                  |                                    |                   |                         | +135=                                          |                |
|                                                                          |                                  |                                    |                   |                         | TOTAL ADDIT. FEE                               |                |

2837

PATENT APPLICATION

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Pascal HAMERY

Application No.: 08/994,013

Filed: December 18, 1997

For: HEARING PROTECTOR AGAINST LOUD NOISE



RECEIVED

JUN 26 1998

GROUP 2100

Docket No.: JAO 40126

*#2  
6-30-98.  
Berridge*

CLAIM FOR PRIORITYAssistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested for the above-identified patent application and the priority provided in 35 U.S.C. §119 is hereby claimed:

French Patent Application No. 97.11623 filed September 18, 1997.

In support of this claim, a certified copy of said original foreign application:

X is filed herewith.       was filed on        in Parent Application No.        filed       .

It is requested that the file of this application be marked to indicate that the requirements of 35 U.S.C. §119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document.

Respectfully submitted,

  
William P. Berridge  
Registration No. 30,024


  
Stephen P. Catlin  
Registration No. 36,101

OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400

|                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| DEPOSIT ACCOUNT USE<br>AUTHORIZATION<br>Please grant any extension<br>necessary for entry;<br>Charge any fee due to our<br>Deposit Account No. 15-0461 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|

REPU LIQUE FRANCAI



# BREVET D'INVENTION

CERTIFICAT D'UTILITÉ - CERTIFICAT D'ADDITION

## COPIE OFFICIELLE

Le Directeur général de l'Institut national de la propriété industrielle certifie que le document ci-annexé est la copie certifiée conforme d'une demande de titre de propriété industrielle déposée à l'Institut.

Fait à Paris, le

12 MARS 1990

Pour le Directeur général de l'Institut  
national de la propriété industrielle  
Le Chef du Département

Martine PLANCHE



26 bis, rue de Saint-Pétersbourg  
75800 Paris Cedex 08

Téléphone : (1) 42.94.52.52 Télécopie : (1) 42.93.59.30

Réserve à l'INPI



Code de la propriété intellectuelle-Livre VI

REQUÊTE EN DÉLIVRANCE

Confirmation d'un dépôt par télécopie

Cet imprimé est à remplir à l'encre noire en lettres capitales

|                                                                                                                                                                                                                                                                                                                                              |  |                                                                                                                                                                                                                                                                             |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>DATE DE REMISE DES PIÈCES</b> <b>18 SEP. 1997</b><br><b>N° D'ENREGISTREMENT NATIONAL</b> <b>97 11623</b><br><b>DEPARTEMENT DE DÉPÔT</b> <b>75</b><br><b>DATE DE DÉPÔT</b> <b>18 SEP. 1997</b>                                                                                                                                             |  | <b>1 NOM ET ADRESSE DU DEMANDEUR OU DU MANDATAIRE</b><br><b>À QUI LA CORRESPONDANCE DOIT ÊTRE ADDRESSEÉE</b><br><br><b>DELEGATION GENERALE POUR L'ARMEMENT</b><br><b>BUREAU DE LA PROPRIÉTÉ INDUSTRIELLE</b><br><b>DSP/SDAG/BPI</b><br><b>26, Bld Victor - 00460 ARMEES</b> |  |
| <b>2 DEMANDE</b> Nature du titre de propriété industrielle<br><input type="checkbox"/> brevet d'invention <input type="checkbox"/> demande divisionnaire<br><input type="checkbox"/> certificat d'utilité <input type="checkbox"/> transformation d'une demande de brevet européen<br><input checked="" type="checkbox"/> brevet d'invention |  | <b>n° du pouvoir permanent</b> <b>références du correspondant</b> <b>téléphone</b><br><b>NN/MR</b> <b>45 52 58 52</b><br><input type="checkbox"/> certificat d'utilité n° _____ date _____                                                                                  |  |
| <b>Etablissement du rapport de recherche</b> <input type="checkbox"/> différé <input checked="" type="checkbox"/> immédiat<br>Le demandeur, personne physique, requiert le paiement échelonné de la redevance <input type="checkbox"/> oui <input type="checkbox"/> non                                                                      |  |                                                                                                                                                                                                                                                                             |  |
| <b>Titre de l'invention (200 caractères maximum)</b><br><b>PROTECTION AUDITIVE CONTRE LES BRUITS ELEVES.</b>                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                                                             |  |
| <b>3 DEMANDEUR (S)</b> <b>n° SIREN</b> _____ <b>code APE/NAF</b> _____<br>Nom et prénoms [souligner le nom patronymique] ou dénomination                                                                                                                                                                                                     |  | Forme juridique                                                                                                                                                                                                                                                             |  |
| <b>INSTITUT FRANCO-ALLEMAND DE RECHERCHES DE SAINT-LOUIS</b>                                                                                                                                                                                                                                                                                 |  |                                                                                                                                                                                                                                                                             |  |
| Nationalité (s) <b>FRANCAISE</b><br>Adresse (s) complète(s)<br><b>5, rue du Général Cassagnou</b><br><b>Boite Postale N° 34</b><br><b>68301 SAINT-LOUIS CEDEX</b>                                                                                                                                                                            |  | Pays<br><b>FRANCE</b>                                                                                                                                                                                                                                                       |  |
| <small>En cas d'insuffisance de place, poursuivre sur papier libre <input type="checkbox"/></small><br><b>4 INVENTEUR (S)</b> Les Inventeurs sont les demandeurs <input type="checkbox"/> oui <input checked="" type="checkbox"/> non    Si la réponse est non, fournir une désignation séparée                                              |  |                                                                                                                                                                                                                                                                             |  |
| <b>5 RÉDUCTION DU TAUX DES REDEVANCES</b> <input type="checkbox"/> requise pour la 1ère fois <input type="checkbox"/> requise antérieurement qu'à dépôt ; joindre copie de la décision d'admission                                                                                                                                           |  |                                                                                                                                                                                                                                                                             |  |
| <b>6 DÉCLARATION DE PRIORITÉ OU REQUÊTE DU BÉNÉFICE DE LA DATE DE DÉPÔT D'UNE DEMANDE ANTIÉRIEURE</b><br>pays d'origine <b>numéro</b> <b>date de dépôt</b> <b>nature de la demande</b><br>                                                                                                                                                   |  |                                                                                                                                                                                                                                                                             |  |
| <b>7 DIVISIONS</b> antérieures à la présente demande <b>n°</b> <b>date</b> <b>n°</b> <b>date</b>                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                             |  |
| <b>8 SIGNATURE DU DEMANDEUR OU DU MANDATAIRE</b><br><small>(nom et qualité du signataire - n° d'inscription)</small><br><b>Mme. Nicole NAHON</b><br>                                                                                                                                                                                         |  | <b>SIGNATURE DU PRÉPOSÉ À LA RÉCEPTION</b><br>                                                                                                                                                                                                                              |  |
| <b>SIGNATURE APRÈS ENREGISTREMENT DE LA DEMANDE À L'INPI</b><br>                                                                                                                                                                                                                                                                             |  |                                                                                                                                                                                                                                                                             |  |



26bis, rue de Saint-Pétersbourg 75800 Paris Cedex 08 Tél. : (1) 42 94 52 52 - Télécopie : (1) 42 93 59 30

Division Administrative des Brevets

DÉSIGNATION DE L'INVENTEUR

(si le demandeur n'est pas l'inventeur ou l'unique inventeur)

N° d'enregistrement national

*gf 11623*

Titre de l'invention :

PROTECTION AUDITIVE CONTRE LES BRUITS ELEVES.

Le (s) soussigné (s)

Mme. Nicole NAHON  
DIRECTION DES SYSTEMES DE FORCES ET DE LA PROSPECTIVE  
SOUS-DIRECTION DE L'ADMINISTRATION ET DE LA GESTION  
BUREAU DE LA PROPRIETE INDUSTRIELLE  
26, Boulevard Victor  
00460 ARMEES

désigne (nt) en tant qu'inventeur (s) (indiquer nom, prénoms, adresse et souligner le nom patronymique) :

Monsieur HAMERY Pascal  
7, rue de Verdun  
68100 MULHOUSE

NOTA : A titre exceptionnel, le nom de l'inventeur peut être suivi de celui de la société à laquelle il appartient (société d'appartenance) lorsque celle-ci est différente de la société déposante ou titulaire.

Date et signature (s) du (des) demandeur (s) ou du mandataire PARIS, le 17 Septembre 1997

Mme. Nicole NAHON

A handwritten signature in black ink, appearing to read 'Nicole Nahon'.

La présente invention concerne une protection auditive contre des bruits élevés continus ou impulsionnels (jusqu'à 190 dB), pouvant fonctionner en mode d'atténuation sélective ou en mode d'atténuation maximale.

En mode d'atténuation sélective, l'atténuation des sons est faible pour une gamme de fréquences définie, et elle augmente pour les sons de fréquence supérieure à ceux de la gamme définie. L'atténuation sélective est particulièrement efficace pour les bruits les plus forts. Un exemple d'application d'une protection auditive en mode d'atténuation sélective est la transmission intelligible de la parole dans un environnement perturbé par des bruits impulsionnels tels que des bruits d'armes. Dans ce cas, la gamme de fréquences définie dans laquelle l'atténuation est faible est de 1000 à 3000 Hz.

En mode d'atténuation maximale, la protection auditive arrête tous les sons sur toute la gamme de fréquences, quelque soit leur intensité.

Selon le brevet FR 2 676 642 au nom de la demanderesse il existe une protection auditive peu encombrante en contact avec le conduit auditif, comprenant essentiellement un corps souple allongé, dans lequel sont placés des moyens d'atténuation sélective et des moyens d'atténuation maximale, et un obturateur d'un canal à commande manuelle permettant de commander le mode de fonctionnement en atténuation sélective ou maximale.

Toutefois, ce dispositif nécessite une manipulation délicate de l'utilisateur devant obturer le canal par lui-même. Cette manipulation peut être imparfaite et l'atténuation sélective ou maximale ainsi recherchée par obturation ne sera pas optimale.

Le but de l'invention est de proposer une protection auditive fiable qui ne présente pas les inconvénients du réglage par l'utilisateur et permette deux configurations d'atténuation de bruits de caractéristiques différentes.

L'invention a donc pour objet une protection auditive pour atténuer sélectivement ou non des bruits pouvant avoir une intensité jusqu'à 190 dB destinée à être insérée de manière étanche dans le conduit auditif, caractérisée en ce qu'elle est constituée d'un corps cylindrique souple présentant à chaque extrémité un embout, l'un au moins des deux embouts comportant un canal allant d'une extrémité de l'embout jusqu'au niveau du centre du corps et contenant un filtre acoustique.

La protection auditive selon l'invention présente deux extrémités aptes l'une comme l'autre à être insérées dans le conduit auditif. Elle est dite "tête-

bêche" ou à "double face". Contrairement à une protection auditive classique qui comporte en général une seule extrémité apte à être insérée dans le conduit auditif, l'autre extrémité permettant de tenir la protection auditive afin de la positionner dans le conduit auditif, la présente invention comprend deux 5 extrémités, identiques ou non, pouvant l'une ou l'autre être insérées dans le conduit auditif, permettant ainsi de choisir parmi deux modes de fonctionnement en atténuation identiques ou non.

L'intérêt d'un tel dispositif réside dans le fait qu'il possède, au sein d'une 10 même protection auditive, deux configurations pouvant présenter des caractéristiques d'atténuation différentes, toutes deux obtenues par simple inversion du sens d'insertion de la protection auditive ou bouchon d'oreille.

Dans un mode de réalisation préférentiel, les deux embouts sont deux 15 pièces distinctes reliées par une pièce de jonction interne.

La pièce de jonction peut être un cylindre unique, percé d'un alésage 20 renfermant un filtre acoustique et formant un angle droit débouchant d'une part par une première extrémité dans le canal, et d'autre part par une deuxième extrémité au niveau du centre de la pièce de jonction.

La pièce de jonction peut être un cylindre unique comportant un 25 alésage débouchant en trois endroits : au niveau du centre de la pièce de jonction, et à chaque extrémité de la pièce de jonction, les parties d'alésage débouchant aux extrémités renfermant chacune un filtre acoustique identique ou différent.

La pièce de jonction peut aussi être constituée de trois parties 30 cylindriques , la partie centrale étant percée d'un alésage en son centre et ayant un diamètre légèrement supérieur à celui des deux autres parties, qui ont un diamètre sensiblement égal et légèrement supérieur à celui du canal, et dont l'une au moins est percée d'un alésage en son centre, qui renferme un filtre acoustique et qui communique avec l'alésage de la partie centrale. Lorsque les deux parties renferment chacune un filtre acoustique, ce dernier peut être identique ou différent.

35 Dans un autre mode de réalisation, la pièce de jonction peut présenter des aspérités pour le maintien des embouts.

Dans un autre mode de réalisation, elle peut avoir des extrémités coniques.

Préférentiellement, les deux embouts de la protection auditive sont 5 munis d'une face sensiblement hémisphérique dont le côté le moins large est destiné à être inséré en premier dans le conduit auditif.

Avantageusement le corps de la protection auditive est pourvu d'ailettes annulaires souples de diamètre croissant de l'intérieur vers l'extérieur du conduit 10 auditif pour le calage dans le conduit auditif.

La protection auditive permet par le choix du filtre acoustique un filtrage non linéaire des sons.

15 D'autres caractéristiques de la présente invention apparaîtront à la lecture de la description suivante d'un mode de réalisation préférentiel, donné à titre illustratif et non limitatif, et des figures annexées parmi lesquelles :

20 -la figure 1 représente en coupe longitudinale un premier mode de réalisation d'une protection auditive "double face" selon l'invention;

-la figure 2 représente en coupe longitudinale un deuxième mode de réalisation d'une protection auditive "double face" selon l'invention;

-la figure 3 représente en coupe longitudinale un troisième mode de réalisation d'une protection auditive "double face" selon l'invention;

25 -la figure 4 représente en coupe longitudinale des variantes de la pièce d'assemblage des deux faces de la protection auditive selon l'invention;

-la figure 5 représente en perspective un mode de réalisation de la pièce d'assemblage des deux faces de la protection auditive selon l'invention;

30 -la figure 6 représente en coupe longitudinale un quatrième mode de réalisation d'une protection auditive selon l'invention.

La figure 1 représente une configuration d'une protection auditive selon l'invention comportant un corps 1, qui est une pièce moulée s'adaptant au conduit auditif, percée d'un canal 2 partant de l'une des deux extrémités et débouchant au 35 niveau du centre du corps 1. Le canal 2 renferme un filtre acoustique 3 permettant par exemple un filtrage sélectif et non linéaire des sons. L'autre extrémité n'est pas

perforée et permet une atténuation maximale quelle que soit la fréquence et quel que soit le niveau d'amplitude du son.

Le corps 1 a une longueur de 2 à 4 cm et est constitué d'une matière souple.

5 La figure 2 représente une configuration d'une protection auditive selon l'invention, dans laquelle le corps 1 est percé d'un canal 2 débouchant à chaque extrémité et au centre du corps 1, et contenant deux filtres acoustiques 3 vers chaque extrémité. Les deux filtres peuvent être identiques ou non.

10 La figure 3 représente un mode de réalisation d'une protection auditive selon l'invention constitué de trois parties : deux embouts cylindriques creux 4 et 7, munis chacun d'une face sensiblement hémisphérique 6, dont le côté le moins large est destiné à être placé en premier dans le conduit auditif, et une troisième pièce interne de jonction 8 de ces deux embouts. La face sensiblement hémisphérique assure l'étanchéité entre la protection auditive et le conduit auditif.

15 L'un au moins des deux embouts est percé d'un canal 5 en son centre, dans lequel est insérée l'une des deux extrémités de la pièce de jonction 8 qui renferme un filtre acoustique 3 permettant par exemple un filtrage sélectif et non linéaire des sons. Le deuxième embout peut ne pas être perforé, et dans ce cas il permet une atténuation maximale quelle que soit la fréquence et quel que soit le 20 niveau d'amplitude du son. Les deux embouts 4 et 7 sont deux pièces distinctes qui s'emboitent l'une sur l'autre et sont assemblées par la troisième pièce 8 permettant de les maintenir solidairement. Cette pièce d'assemblage 8 est percée d'un alésage 9 renfermant un filtre acoustique et présentant un angle droit débouchant d'une part par une première extrémité dans le canal 5, permettant ainsi l'utilisation du filtre 3, et d'autre part par une deuxième extrémité au niveau 25 du centre de la pièce 8.

30 Dans un autre mode de réalisation, la pièce 8 peut aussi comporter un alésage débouchant en trois endroits : au niveau du centre de la pièce 8, et à chaque extrémité de la pièce 8, les parties d'alésage débouchant aux extrémités renfermant chacune un filtre acoustique identique ou non.

La pièce de jonction 8 peut être constituée simplement par un cylindre unique ou être constituée de trois parties cylindriques 10, 11, 12 comme sur la figure 4a. La partie centrale 12 est percée d'un alésage en son centre et a un diamètre légèrement supérieur à celui des deux autres parties 10 et 11, qui ont un diamètre sensiblement égal et légèrement supérieur à celui du canal 5 pour permettre un bon maintien de l'ensemble. L'une au moins des deux parties 10 et

11 est percée d'un alésage qui renferme un filtre acoustique et communique avec l'alésage de la partie 12, comme cela est indiqué sur la figure 5.

La pièce de jonction 8 peut présenter des aspérités comme sur la figure 4b ou bien avoir des extrémités 13 et 14 de forme conique comme sur les figures 4c et 5. Dans le cas du mode de réalisation en trois parties, les parties 10 et 11 sont porteuses des aspérités et des extrémités coniques.

L'un des deux embouts comporte une perforation qui vient lors de l'assemblage avec la pièce de jonction 8 en coincidence avec celle de l'extrémité centrale du canal 9 située sur la partie 12.

10 La figure 6 représente une vue en coupe longitudinale d'une configuration de protection auditive selon l'invention, pourvue sur les embouts d'ailettes annulaires souples 15 pour assurer le calage de la protection auditive dans les parois du conduit auditif. Ces ailettes peuvent être de diamètre croissant de l'intérieur vers l'extérieur du conduit auditif.

15 La protection auditive selon l'invention est particulièrement utile pour les équipages d'avions ou de véhicules militaires en exercice, qui sont exposés à des bruits de moteurs et d'armes très élevés.

20 La protection auditive selon l'invention peut aussi être efficacement utilisée par tout personnel exposé à des bruits de forte intensité dans leur environnement de travail : chantiers de construction, carrières, etc.

## REVENDICATIONS

1. Protection auditive pour atténuer sélectivement ou non des bruits  
5 pouvant avoir une intensité jusqu'à 190 dB destinée à être insérée de manière étanche dans le conduit auditif, caractérisée en ce qu'elle est constituée d'un corps (1) cylindrique souple présentant à chaque extrémité un embout, l'un des deux embouts comportant un canal (2,5,9) allant d'une extrémité de l'embout jusqu'au niveau du centre du corps (1) et contenant un filtre acoustique (3).

10

2. Protection auditive pour atténuer sélectivement ou non des bruits pouvant avoir une intensité jusqu'à 190 dB destinée à être insérée de manière étanche dans le conduit auditif, caractérisée en ce qu'elle est constituée d'un corps (1) cylindrique souple présentant à chaque extrémité un embout, chaque embout 15 comportant un canal (2,5,9) allant d'une extrémité de l'embout jusqu'au niveau du centre du corps (1) et contenant un filtre acoustique (3) identique ou non.

3. Protection auditive selon la revendication 1 ou 2, caractérisée en ce que les deux embouts sont deux pièces distinctes reliées par une pièce de jonction 20 interne (8).

4. Protection auditive selon les revendications 1 et 3, caractérisée en ce que la pièce de jonction (8) est un cylindre unique, percé d'un alésage (9) renfermant un filtre acoustique et formant un angle droit débouchant d'une part 25 par une première extrémité dans le canal (5), et d'autre part par une deuxième extrémité au niveau du centre de la pièce de jonction (8).

5. Protection auditive selon les revendications 2 et 3, caractérisée en ce que la pièce de jonction (8) est un cylindre unique comportant un alésage 30 débouchant en trois endroits : au niveau du centre de la pièce de jonction (8), et à chaque extrémité de la pièce de jonction (8), les parties d'alésage débouchant aux extrémités renfermant chacune un filtre acoustique identique ou non.

6. Protection auditive selon les revendications 1 et 3, caractérisée en ce 35 que la pièce de jonction (8) est constituée de trois parties cylindriques (10, 11, 12), la partie centrale 12 étant percée d'un alésage en son centre et ayant un diamètre légèrement supérieur à celui des deux autres parties (10 et 11), qui ont

un diamètre sensiblement égal et légèrement supérieur à celui du canal (5), et dont l'une est percée d'un alésage en son centre, qui renferme un filtre acoustique et qui communique avec l'alésage de la partie centrale (12).

5        7. Protection auditive selon les revendications 2 et 3, caractérisée en ce que la pièce de jonction (8) est constituée de trois parties cylindriques (10, 11, 12), la partie centrale (12) étant percée d'un alésage en son centre et ayant un diamètre légèrement supérieur à celui des deux autres parties (10 et 11), qui ont un diamètre sensiblement égal et légèrement supérieur à celui du canal (5), et qui 10 sont toutes deux percées d'un alésage en son centre, qui communique avec l'alésage de la partie centrale (12) et qui renferme un filtre acoustique identique ou non.

15        8. Protection auditive selon l'une des revendications 3 à 7, caractérisée en ce que la pièce de jonction (8) présente des aspérités pour le maintien des embouts (4,7).

20        9. Protection auditive selon l'une des revendications 3 à 7, caractérisée en ce que la pièce de jonction (8) a des extrémités coniques (13,14).

25        10. Protection auditive selon l'une des revendications 1 à 9, caractérisée en ce que les deux embouts de la protection auditive sont munis d'une face sensiblement hémisphérique (6) dont le côté le moins large est destiné à être inséré en premier dans le conduit auditif.

30        11. Protection auditive selon l'une des revendications 1 à 10, caractérisée en ce que le corps (1) est pourvu d'ailettes annulaires souples (15) de diamètre croissant de l'intérieur vers l'extérieur du conduit auditif pour le calage dans le conduit auditif.

12. Protection auditive selon l'une des revendications 1 à 11, caractérisée en ce que le filtre acoustique permet un filtrage non linéaire des sons.

I / III

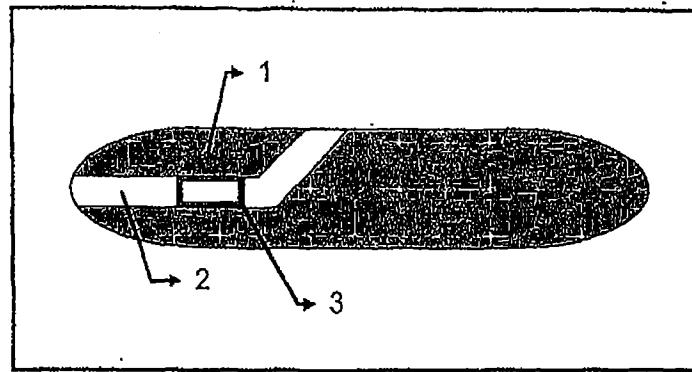


Figure 1

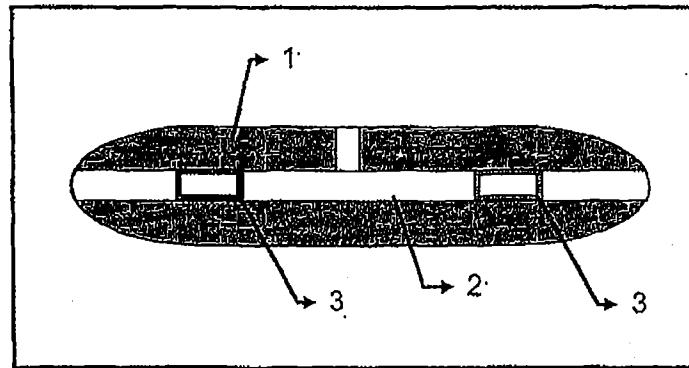


Figure 2

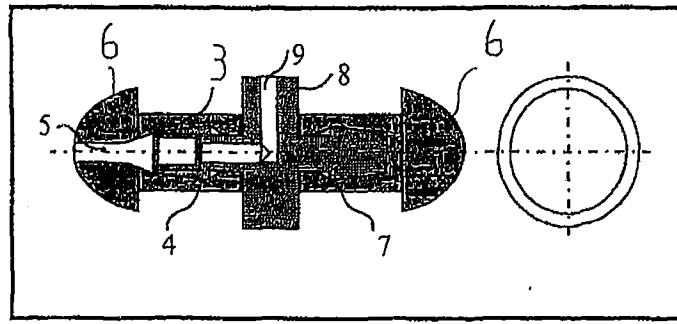


Figure 3

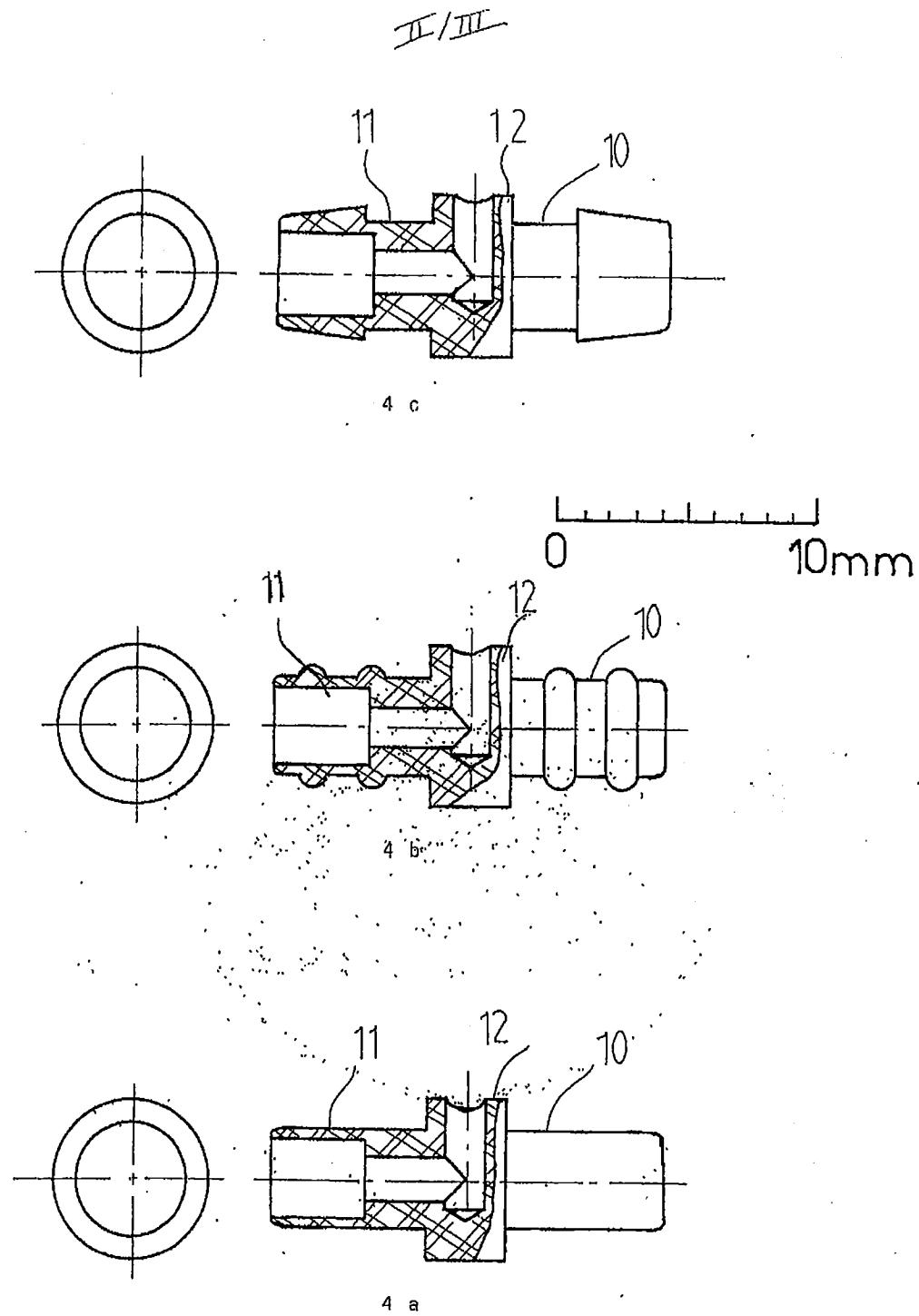


Figure 4

III/III

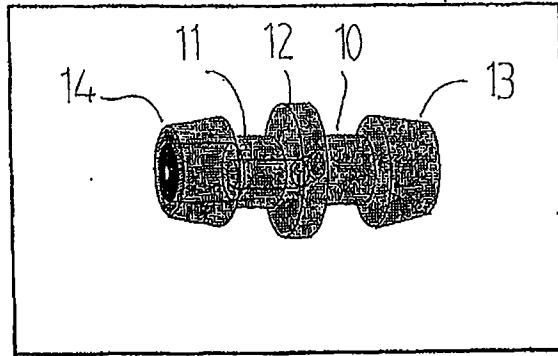


Figure 5

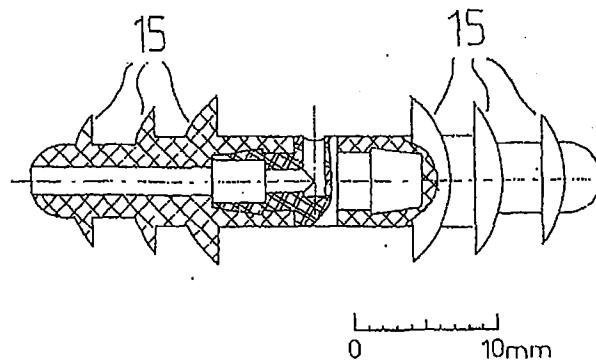


Figure 6



UNITED STATES DEPARTMENT OF COMMERCE  
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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|-----------------|-------------|----------------------|---------------------|
| 08/7994.015     | 12/18/97    | HANERY               | P WPG40126          |

CLIFF & MERRIDGE  
P O BOX 19928  
ALEXANDRIA VA 22320

MMS1/0908-

EXAMINER

DANG, K

ART UNIT

PAPER NUMBER

2837

DATE MAILED: 09/08/98

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

| Office Action Summary | Application No. | Applicant(s)                                                                        |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|
|                       | 08/994,015      | Hanery                                                                              |
| Examiner              | Group Art Unit  |  |
| Khanh Dang            | 2837            |                                                                                     |

- Responsive to communication(s) filed on \_\_\_\_\_.  
 This action is FINAL.  
 Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 1 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

**Disposition of Claims**

- Claim(s) 1-33 is/are pending in the application.  
Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
 Claim(s) \_\_\_\_\_ is/are allowed.  
 Claim(s) \_\_\_\_\_ is/are rejected.  
 Claim(s) \_\_\_\_\_ is/are objected to.  
 Claims 1-33 are subject to restriction or election requirement.

**Application Papers**

- See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.  
 The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.  
 The proposed drawing correction, filed on \_\_\_\_\_ is  approved  disapproved.  
 The specification is objected to by the Examiner.  
 The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. § 119**

- Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).  
 All  Some\*  None of the CERTIFIED copies of the priority documents have been  
 received.  
 received in Application No. (Series Code/Serial Number) \_\_\_\_\_.  
 received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

- Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

**Attachment(s)**

- Notice of References Cited, PTO-892  
 Information Disclosure Statement(s), PTO-1449, Paper No(s), \_\_\_\_\_.  
 Interview Summary, PTO-413  
 Notice of Draftsperson's Patent Drawing Review, PTO-948  
 Notice of Informal Patent Application, PTO-152

-- SEE OFFICE ACTION ON THE FOLLOWING PAGES --

Application/Control Number: 08/994,015

Page 2

Art Unit: 2837

#### **DETAILED ACTION**

##### *Election/Restriction*

1. This application contains claims directed to the following patentably distinct species of the claimed invention: the species shown in Fig. 1, the species shown in Fig. 2, the species shown in Fig. 3, the species shown in Fig. 4(a), the species shown in Fig. 4(b), the species shown in Fig. 4(c), the species shown in Fig. 5, and the species shown in Fig. 6.

Applicant is required under 35 U.S.C. 121 to elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claim 1 is generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to

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Page 3

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be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

Any inquiry concerning this communication should be directed to K. Dang at telephone number (703) 308-0211.

*Khánh Dang*

KHANH DANG  
PRIMARY EXAMINER  
GROUP 2100

FORM PTO 948 (REV. 11-27)

U.S. DEPARTMENT OF COMMERCE-Patent and Trademark Office

Application No. 08/994015

NOTICE OF DRAFTPERSON'S  
PATENT DRAWING REVIEWThe drawing filed (insert date) 12/18/97 are:

- A.  not objected to by the Draftperson under 37 CFR 1.84 or 1.152.
- B.  objected to by the Draftperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings where necessary. Corrected drawings must be submitted according to the instructions on the back of this notice.

## 1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings:

- Black ink. Color.  
 Color drawing are not acceptable until petition is granted.  
 Fig(s) \_\_\_\_\_  
 Pen and ink black ink is not permitted. Fig(s) \_\_\_\_\_

## 2. PHOTOGRAPHS. 37 CFR 1.84(b)

- Photographs are not acceptable until petition is granted.  
 3 full-tone sets are required. Fig(s) \_\_\_\_\_  
 Photographs not properly mounted (must bristol board or photographic double-weight paper). Fig(s) \_\_\_\_\_  
 Poor quality (half-tone). Fig(s) \_\_\_\_\_

## 3. TYPE OF PAPER. 37 CFR 1.84(c)

- Paper not flexible, strong, white and durable.  
 Fig(s) \_\_\_\_\_  
 Tissues, alterations, overwritings, interlineations, folds, copy machine marks not acceptable. (too thin)  
 Mylar, vellum paper is not acceptable (too thin).  
 Fig(s) \_\_\_\_\_

## 4. SIZE OF PAPER. 37 CFR 1.84(d): Acceptable sizes:

- 21.0 cm by 29.7 cm (DIN size A4)  
 21.6 cm by 27.9 cm (8 1/2 x 11 inches)  
 All drawings sheets not the same size.  
 Sheet(s) \_\_\_\_\_

## 5. MARGINS. 37 CFR 1.84(g): Acceptable margins:

- Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm  
SIZE: A4 Size  
Top 2.5 cm Left 2.5 cm Right 1.5 cm Bottom 1.0 cm  
SIZE: 8 1/2 x 11  
 Margins not acceptable. Fig(s) 4 - 5  
 Top (T) \_\_\_\_\_ Left (L) \_\_\_\_\_  
 Right (R) \_\_\_\_\_ Bottom (B) \_\_\_\_\_

## 6. VIEWS. 37 CFR 1.84(h)

- REMINDER: Specification may require revision to correspond to drawing changes.  
 Views connected by projection lines or lead lines.  
 Fig(s) \_\_\_\_\_  
Partial views. 37 CFR 1.84(h)(2)  
 Brackets needed to show figure as one entity.  
 Fig(s) \_\_\_\_\_  
 Views not labeled separately or properly.  
 Fig(s) \_\_\_\_\_  
 Enlarged view not labeled separately or properly.  
 Fig(s) \_\_\_\_\_

## 7. SECTIONAL VIEWS. 37 CFR 1.84(h)(3)

- Hatching not indicated for sectional portions of an object.  
 Fig(s) \_\_\_\_\_  
 Sectional designation should be noted with Arabic or Roman numbers. Fig(s) \_\_\_\_\_

## 8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)

- Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned, so that the top becomes the right side, except for graphs. Fig(s) \_\_\_\_\_  
 Views not on the same plane on drawing sheet. Fig(s) \_\_\_\_\_

## 9. SCALE. 37 CFR 1.84(k)

- Scale not large enough to show mechanism without crowding when drawing is reduced in size to two-thirds in reproduction.  
 Fig(s) \_\_\_\_\_

## 10. CHARACTER OF LINES, NUMBERS, &amp; LETTERS. 37 CFR 1.84(l)

- Lines, numbers & letters not uniformly thick and well defined, clean, durable and black (poor line quality).  
 Fig(s) 6

## 11. SHADING. 37 CFR 1.84(m)

- Solid black areas pale. Fig(s) \_\_\_\_\_  
 Solid black shading not permitted. Fig(s) \_\_\_\_\_  
 Shaded lines, pale, rough and blurred. Fig(s) \_\_\_\_\_

## 12. NUMBERS, LETTERS, &amp; REFERENCE CHARACTERS. 37 CFR 1.48(p)

- Numbers and reference characters not plain and legible.  
 Fig(s) \_\_\_\_\_  
 Figure legends are poor. Fig(s) \_\_\_\_\_

- Numbers and reference characters not oriented in the same direction as the view. 37 CFR 1.84(p)(3) Fig(s) \_\_\_\_\_  
 English alphabet not used. 37 CFR 1.84(p)(3) Fig(s) \_\_\_\_\_  
 Numbers, letters and reference characters must be at least .32 cm (1/8 inch) in height. 37 CFR 1.84(p)(3) Fig(s) 4 - 6

## 13. LEAD LINES. 37 CFR 1.84(q)

- Lead lines cross each other. Fig(s) \_\_\_\_\_  
 Lead lines missing. Fig(s) \_\_\_\_\_

## 14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.48(t)

- Sheets not numbered consecutively, and in Arabic numerals beginning with number 1. Fig(s) \_\_\_\_\_

15. NUMBERING OF VIEWS. 37 CFR 1.84(u)  
 Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s) \_\_\_\_\_

## 16. CORRECTIONS. 37 CFR 1.84(w)

- Corrections not made from PTO-948 dated \_\_\_\_\_

## 17. DESIGN DRAWINGS. 37 CFR 1.152

- Surface shading shown not appropriate. Fig(s) \_\_\_\_\_  
 Solid black shading not used for color contrast.  
 Fig(s) \_\_\_\_\_

## COMMENTS

REVIEWER

Rod KOKER

DATE 03/31/98

TELEPHONE NO. 703 385 8404

ATTACHMENT TO PAPER NO.

3

PTO COPY

*Approved w/m*

**PATENT APPLICATION**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

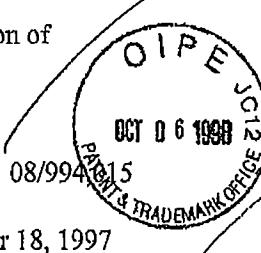
In re the Application of

Pascal HAMERY

Application No.: 08/994,615

Filed: December 18, 1997

For: HEARING PROTECTOR AGAINST LOUD NOISE



Group Art Unit: 2837

Examiner: K. Dang

Docket No.: WPB 40126

# 4  
10-9-98  
JProdan

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

The Examiner is requested to review and approve the enclosed substitute drawings for Figures 1-3 and 5-6 for the original drawings which were filed on December 18, 1997. The substitute drawings are filed to more clearly show the details of the hearing detector which may have been too dark in the originally filed drawings. The substitute drawings originate from the priority document as did the originally filed drawings. Accordingly, no new matter is presented.

Upon approval of the substitute drawings by the Examiner, and upon allowance of this application, the formal drawings will be corrected.

Respectfully submitted,

William P. Berridge  
Registration No. 30,024

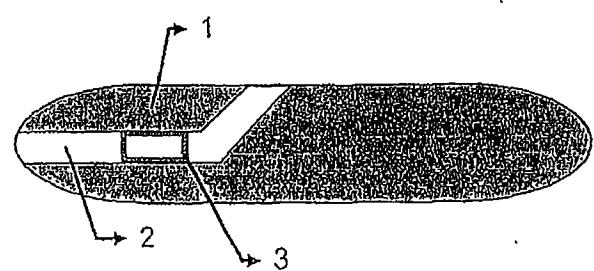
Eric D. Morehouse  
Registration No. 38,565

WPB:MO/mdo

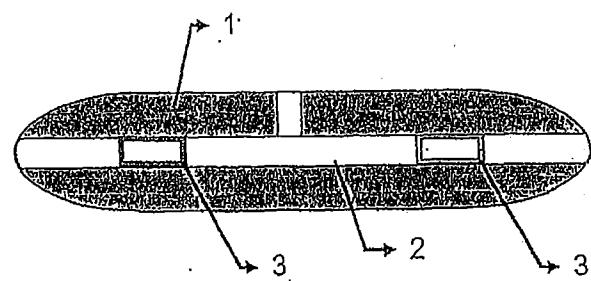
OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400

**DEPOSIT ACCOUNT USE  
AUTHORIZATION**  
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necessary for entry;  
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Deposit Account No. 15-0461

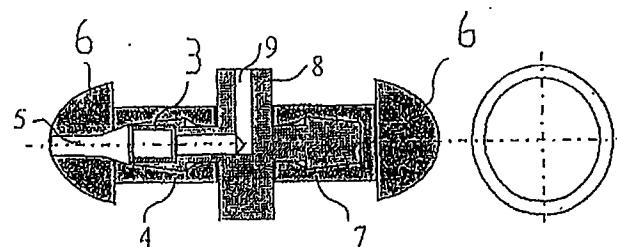
Approved  
JEN



**Figure 1**

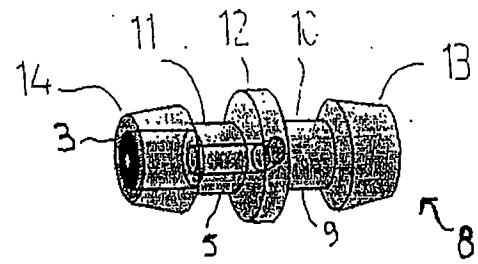


**Figure 2**

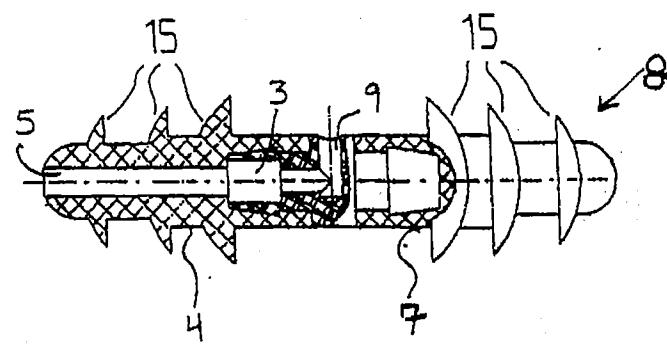


**Figure 3**

Approved  
JCD



**Figure 5**



**Figure 6**

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of  
Pascal HAMERY



Application No.: 08/994,015

Group Art Unit: 2837

Filed: December 18, 1997

Examiner: K. Dang

For: HEARING PROTECTOR AGAINST LOUD NOISE

Docket No.: JAO 40126

#5  
10-9-98  
J Prochn

RESPONSE TO ELECTION OF SPECIES REQUIREMENT

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

In reply to the Election of Species Requirement dated September 8, 1998, Applicant elects Species 8. Claims 1-16 read on the elected species, with at least claim 1 being generic to all species. The election is made with traverse.

The Requirement is traversed as it is respectfully submitted that the subject matter of all species is sufficiently related that a thorough search for the subject matter for any one group of claims would necessarily encompass a search for the subject matter for the remaining claims. Thus, it is respectfully submitted that the search and the examination of the entire application could be made without serious burden. See MPEP §803 in which it is stated that, "If the search and examination of the entire application can be made without serious burden, the Examiner must examine it on the merits, even though it includes claims to distinct or independent inventions." (emphasis added). It is respectfully submitted that this

RECEIVED  
CUST & ATTN: GROUP 2837  
OCT 07 1998

Application No. 08/994,015

policy should apply in the present application in order to avoid unnecessary delay and expense to Applicant and duplicative examination by the Patent Office.

Respectfully submitted,

  
William P. Berridge  
Registration No. 30,024

  
Eric D. Morehouse  
Registration No. 38,565

WPB:MO/mdo

OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400

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## UNITED STATES DEPARTMENT OF COMMERCE

## Patent and Trademark Office

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|-----------------|-------------|----------------------|---------------------|
| 08/994,015      | 12/18/97    | HAMERY               | P WPA40126          |

PHILIP E HERRIDGE  
 P O BOX 19928  
 ALEXANDRIA VA 22320

MM011/1020

 EXAMINER

PANG, K

| ART UNIT | PAPER NUMBER |
|----------|--------------|
| 2837     | 6            |

DATE MAILED: 10/20/98

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

| Office Action Summary                                                                                                                                                                                                                                                                                                                                                           | Application No.<br>08/994,016 | Applicant(s)<br>Hamery |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                 | Examiner<br>Khanh Dang        | Group Art Unit<br>2837 |
| <input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>Oct 6, 1998</u>                                                                                                                                                                                                                                                                                  |                               |                        |
| <input type="checkbox"/> This action is FINAL.                                                                                                                                                                                                                                                                                                                                  |                               |                        |
| <input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i> , 1935 C.D. 11; 453 O.G. 213.                                                                                                                                      |                               |                        |
| A shortened statutory period for response to this action is set to expire <u>3</u> month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a). |                               |                        |
| <b>Disposition of Claims</b>                                                                                                                                                                                                                                                                                                                                                    |                               |                        |
| <input checked="" type="checkbox"/> Claim(s) <u>1-33</u> is/are pending in the application.                                                                                                                                                                                                                                                                                     |                               |                        |
| <input type="checkbox"/> Of the above, claim(s) <u>17-33</u> is/are withdrawn from consideration.                                                                                                                                                                                                                                                                               |                               |                        |
| <input type="checkbox"/> Claim(s) _____ is/are allowed.                                                                                                                                                                                                                                                                                                                         |                               |                        |
| <input checked="" type="checkbox"/> Claim(s) <u>1, 15, and 16</u> is/are rejected.                                                                                                                                                                                                                                                                                              |                               |                        |
| <input checked="" type="checkbox"/> Claim(s) <u>2-14</u> is/are objected to.                                                                                                                                                                                                                                                                                                    |                               |                        |
| <input type="checkbox"/> Claims _____ are subject to restriction or election requirement.                                                                                                                                                                                                                                                                                       |                               |                        |
| <b>Application Papers</b>                                                                                                                                                                                                                                                                                                                                                       |                               |                        |
| <input type="checkbox"/> See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.                                                                                                                                                                                                                                                                              |                               |                        |
| <input type="checkbox"/> The drawing(s) filed on _____ is/are objected to by the Examiner.                                                                                                                                                                                                                                                                                      |                               |                        |
| <input type="checkbox"/> The proposed drawing correction, filed on _____ is <input type="checkbox"/> approved <input type="checkbox"/> disapproved.                                                                                                                                                                                                                             |                               |                        |
| <input type="checkbox"/> The specification is objected to by the Examiner.                                                                                                                                                                                                                                                                                                      |                               |                        |
| <input type="checkbox"/> The oath or declaration is objected to by the Examiner.                                                                                                                                                                                                                                                                                                |                               |                        |
| <b>Priority under 35 U.S.C. § 119</b>                                                                                                                                                                                                                                                                                                                                           |                               |                        |
| <input checked="" type="checkbox"/> Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(e)-(d).                                                                                                                                                                                                                                                       |                               |                        |
| <input checked="" type="checkbox"/> All <input type="checkbox"/> Some* <input type="checkbox"/> None of the CERTIFIED copies of the priority documents have been received.                                                                                                                                                                                                      |                               |                        |
| <input type="checkbox"/> received in Application No. (Series Code/Serial Number) _____.                                                                                                                                                                                                                                                                                         |                               |                        |
| <input type="checkbox"/> received in this national stage application from the International Bureau (PCT Rule 17.2(a)).                                                                                                                                                                                                                                                          |                               |                        |
| *Certified copies not received: _____                                                                                                                                                                                                                                                                                                                                           |                               |                        |
| <input type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).                                                                                                                                                                                                                                                                     |                               |                        |
| <b>Attachment(s)</b>                                                                                                                                                                                                                                                                                                                                                            |                               |                        |
| <input checked="" type="checkbox"/> Notice of References Cited, PTO-892                                                                                                                                                                                                                                                                                                         |                               |                        |
| <input type="checkbox"/> Information Disclosure Statement(s), PTO-1449, Paper No(s). _____                                                                                                                                                                                                                                                                                      |                               |                        |
| <input type="checkbox"/> Interview Summary, PTO-413                                                                                                                                                                                                                                                                                                                             |                               |                        |
| <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review, PTO-948                                                                                                                                                                                                                                                                                                |                               |                        |
| <input type="checkbox"/> Notice of Informal Patent Application, PTO-152                                                                                                                                                                                                                                                                                                         |                               |                        |
| --- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---                                                                                                                                                                                                                                                                                                                                |                               |                        |

Application/Control Number: 08/994,015

Page 2

Art Unit: 2837

#### **DETAILED ACTION**

1. Applicant's election with traverse of the species of Fig. 6 in Paper No. 6 is acknowledged. The traversal is on the ground(s) that "the search and examination of the entire application could be made without serious burden." This is not found persuasive because the claims are directed to a plurality of species. A large number of independent and distinct species is evidence of serious burden. In any event, "the reasons for insisting upon election of one species, are the facts relied on for the conclusion that there are claims restricted, respectively, to two or more patentably different species that are disclosed in the application, and it is not necessary to show a separate status in the art or separate classification [(evidence of serious burden)]." See MPEP 803.01(a).

The requirement is still deemed proper and is therefore made **FINAL**.

#### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 is rejected under 35 U.S.C. 102(b) as being clearly anticipated by Killion (4,852,683).

Application/Control Number: 08/994,015

Page 3

Art Unit: 2837

Claims 1, 15, and 16 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Killion et al. (5,113,967)

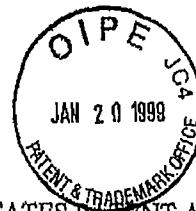
*Allowable Subject Matter*

3. Claims 2-14 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
4. U.S. Patent No. 4,587,965 to de Boer et al. Is cited as relevant art.
5. Any inquiry concerning this communication should be directed to K. Dang at telephone number (703) 308-0211.

*Khánh Dang*

KHÁNH DANG  
PRIMARY EXAMINER  
GROUP 2100

| <i>Notice of References Cited</i> |                                                                 | Application No.<br>08/994,015 | Applicant(s)<br>Hamery |             |          |          |
|-----------------------------------|-----------------------------------------------------------------|-------------------------------|------------------------|-------------|----------|----------|
|                                   |                                                                 | Examiner<br>Khanh Dang        | Group Art Unit<br>2837 | Page 1 of 1 |          |          |
| <b>U.S. PATENT DOCUMENTS</b>      |                                                                 |                               |                        |             |          |          |
|                                   | DOCUMENT NO.                                                    | DATE                          | NAME                   | CLASS       | SUBCLASS |          |
| A                                 | 4,587,985                                                       | 5/86                          | De Boer et al.         | 126         | 867      |          |
| B                                 | 5,113,967                                                       | 5/92                          | Killion et al.         | 181         | 135      |          |
| C                                 | 4,852,683                                                       | 8/89                          | Killion                | 181         | 135      |          |
| D                                 |                                                                 |                               |                        |             |          |          |
| E                                 |                                                                 |                               |                        |             |          |          |
| F                                 |                                                                 |                               |                        |             |          |          |
| G                                 |                                                                 |                               |                        |             |          |          |
| H                                 |                                                                 |                               |                        |             |          |          |
| I                                 |                                                                 |                               |                        |             |          |          |
| J                                 |                                                                 |                               |                        |             |          |          |
| K                                 |                                                                 |                               |                        |             |          |          |
| L                                 |                                                                 |                               |                        |             |          |          |
| M                                 |                                                                 |                               |                        |             |          |          |
| <b>FOREIGN PATENT DOCUMENTS</b>   |                                                                 |                               |                        |             |          |          |
|                                   | DOCUMENT NO.                                                    | DATE                          | COUNTRY                | NAME        | CLASS    | SUBCLASS |
| N                                 |                                                                 |                               |                        |             |          |          |
| O                                 |                                                                 |                               |                        |             |          |          |
| P                                 |                                                                 |                               |                        |             |          |          |
| Q                                 |                                                                 |                               |                        |             |          |          |
| R                                 |                                                                 |                               |                        |             |          |          |
| S                                 |                                                                 |                               |                        |             |          |          |
| T                                 |                                                                 |                               |                        |             |          |          |
| <b>NON-PATENT DOCUMENTS</b>       |                                                                 |                               |                        |             |          |          |
|                                   | DOCUMENT (Including Author, Title, Source, and Pertinent Pages) |                               |                        |             | DATE     |          |
| U                                 |                                                                 |                               |                        |             |          |          |
| V                                 |                                                                 |                               |                        |             |          |          |
| W                                 |                                                                 |                               |                        |             |          |          |
| X                                 |                                                                 |                               |                        |             |          |          |

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Pascal HAMERY

Group Art Unit: 2837

Application No.: 08/994,015

Examiner: K. Dang

Filed: December 18, 1997

Docket No.: WPB 40126

For: HEARING PROTECTOR AGAINST LOUD NOISE

*Entered by  
Pascal H  
J. Dang*

*Amend A  
RE J. Dang  
3/12/99*

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33 JAN 21 PM 12:50  
TECHNOLOGY CENTER 2800

AMENDMENT UNDER 37 CFR 1.111Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

In reply to the Office Action dated October 20, 1998, please amend the above-identified application as follows:

IN THE CLAIMS:

Please cancel claims 2 and 17-33 without prejudice or disclaimer. Please amend claims 1, 3-4, 7, and 11-14 as follows:

1. (Amended) A hearing protector capable of selectively or automatically attenuating noises having intensities up to 190 dB, the hearing protector being intended to be sealingly inserted into an auditory canal of a user, the hearing protector comprising:  
a cylindrical body having a center, a first end and a second end;  
a channel extending from at least one of said first and said second ends of said body to said center of said body; [and]  
said channel contains an acoustic filter; and

Application No. 08/994,015

a ferrule at each of said first and said second ends, wherein said ferrules are  
separate and said cylindrical body forms an internal connector linking said ferrules.

Claim 3, line 1, change "2" to --1--.

Claim 4, line 1, change "2" to --1--.

Claim 7, line 1, change "2" to --1--.

Claim 11, line 1, change "2" to --1--.

Claim 12, line 1, change "2" to --1--.

Claim 13, line 1, change "2" to --1--.

Claim 14, line 1, change "2" to --1--.

#### REMARKS

Claims 1 and 3-16 are pending. By this Amendment, claims 2 and 17-33 are canceled and claims 1, 3-4, 7, and 11-14 are amended. No new matter is presented.

The Office Action rejects claims 1 and 15-16 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,133,967 to Killion et al. Applicant respectfully traverses the rejection. However, in order to expedite prosecution, the allowable subject matter of claim 2 has been incorporated into independent claim 1, thereby rendering the rejection moot and placing claim 1 in condition for allowance.

Claims 3-16 depend from claim 1 and are also allowable over the Killion et al. patent for the same reasons claim 1 is allowable, as well as for the additional features they recite. Accordingly, Applicant respectfully requests withdrawal of the rejection.

Although Applicant acknowledges the indication that claims 2-14 would be allowable if rewritten in independent form including all of the features of the base claim and any intervening claims, in view of the foregoing, reconsideration of the application, withdrawal of

Application No. 08/994,015

the outstanding rejection, allowance of claims 1 and 3-16, and the prompt issuance of a Notice of Allowance are respectfully solicited.

Should the Examiner believe anything further is required in order to place this application in better condition for allowance, the Examiner is requested to contact the undersigned at the telephone number listed below.

Respectfully submitted,



William P. Berridge  
Registration No. 30,024

Murat Ozgu  
Registration No. P-44,275

WPB:MO/mdo

OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400



UNITED STATES DEPARTMENT OF COMMERCE

Patent and Trademark Office

Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231

| SERIAL NUMBER | FILING DATE | FIRST NAMED APPLICANT | ATTORNEY DOCKET NO. |
|---------------|-------------|-----------------------|---------------------|
| 08/991,015    | 12/16/97    | HAMERY                | P WPG40126          |

OLIVER & BERRIDGE,  
P O BOX 19920  
ALEXANDRIA VA 22320

MMR11/0216

| EXAMINER |              |
|----------|--------------|
| BANG, K  |              |
| ART UNIT | PAPER NUMBER |
| 2037     |              |

DATE MAILED:  
02/16/98

Please find below a communication from the EXAMINER in charge of this application.

Commissioner of Patents

| <b>Notice of Allowability</b> | Application No.<br>08/994,015 | Applicant(s)           | Hanery                                                                              |
|-------------------------------|-------------------------------|------------------------|-------------------------------------------------------------------------------------|
|                               | Examiner<br>Khanh Dang        | Group Art Unit<br>2837 |  |

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

This communication is responsive to 1/20/99 Amendment.

The allowed claim(s) is/are 1 and 3-16.

The drawings filed on \_\_\_\_\_ are acceptable.

Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

All  Some\*  None of the CERTIFIED copies of the priority documents have been

received.

received in Application No. (Series Code/Serial Number) \_\_\_\_\_.

received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_.

Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

Applicant MUST submit NEW FORMAL DRAWINGS

because the originally filed drawings were declared by applicant to be informal.

including changes required by the Notice of Draftsperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. 3.

including changes required by the proposed drawing correction filed on Oct 6, 1998, which has been approved by the examiner.

including changes required by the attached Examiner's Amendment/Comment.

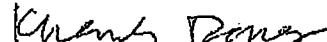
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

- Notice of References Cited, PTO-892
- Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_
- Notice of Draftsperson's Patent Drawing Review, PTO-948
- Notice of Informal Patent Application, PTO-152
- Interview Summary, PTO-413
- Examiner's Amendment/Comment
- Examiner's Comment Regarding Requirement for Deposit of Biological Material
- Examiner's Statement of Reasons for Allowance



KHANH DANG  
PRIMARY EXAMINER  
GROUP 2100

KHANH DANG  
PRIMARY EXAMINER  
ART UNIT 2837



UNITED STATES DEPARTMENT OF COMMERCE  
Patent and Trademark Office

**NOTICE OF ALLOWANCE AND ISSUE FEE DUE**

Case No. 0:14-cv-01821-JNE-KMM  
Filing Date: 07/30/2014  
Issue Date: 01/18/2013  
Attorney File No.: 117500000US

| APPLICATION NO.       | FILING DATE | TOTAL CLAIMS | EXAMINER AND GROUP ART UNIT | DATE MAILED |
|-----------------------|-------------|--------------|-----------------------------|-------------|
| 14/036111             | 07/30/2014  | 0            | DRIPPLEY, J.                | 01/18/2013  |
| First Named Applicant |             |              |                             |             |

TITLE OF  
INVENTION

| ATTY'S DOCKET NO. | CLASS-SUBCLASS | BATCH NO. | APPLN. TYPE | SMALL ENTITY | FEES DUE | DATE DUE |
|-------------------|----------------|-----------|-------------|--------------|----------|----------|
|                   |                |           |             |              |          |          |

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT.  
PROSECUTION ON THE MERITS IS CLOSED.**

**THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS  
APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.**

**HOW TO RESPOND TO THIS NOTICE:**

- I. Review the SMALL ENTITY status shown above.  
If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:
  - A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the Patent and Trademark Office of the change in status, or
  - B. If the status is the same, pay the FEE DUE shown above.
- If the SMALL ENTITY is shown as NO:
  - A. Pay FEE DUE shown above, or
  - B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.
- II. Part B-Issue Fee Transmittal should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B Issue Fee Transmittal should be completed and returned. If you are charging the ISSUE FEE to your deposit account, section "4b" of Part B-Issue Fee Transmittal should be completed and an extra copy of the form should be submitted.
- III. All communications regarding this application must give application number and batch number.  
Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.**

7566  
7/10/99  
5/11/99

JF 9/11  
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PATENT APPLICATION

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

O I P E

Pascal HAMERY

APR 26 1999

PATENT &amp; TRADEMARK OFFICE

Application No.: 08/994,015

Batch No.: P14

Allowed: 02/16/99

Group Art Unit: 2837

Examiner: K. Dang

Filed: December 18, 1997

Docket No.: WPB 40126

For: HEARING PROTECTOR AGAINST LOUD NOISES

LETTER TO THE OFFICIAL DRAFTSPERSON

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

Please substitute the attached 3 sheets of formal drawings depicting Figures 1-6 for the corresponding drawings filed with the application. The attached drawings have been corrected pursuant to the Notice re Patent Drawings attached to Paper No. 3 and including the proposed drawing corrections filed on October 6, 1998, which have been approved by the Examiner.

Respectfully submitted,

William P. Berridge  
Registration No. 30,024

Murat Ozgu  
Registration No. 44,275

WPB:MO/mdo

OLIFF & BERRIDGE, PLC  
P.O. Box 19928  
Alexandria, Virginia 22320  
Telephone: (703) 836-6400

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| Charge any fees due to our<br>Deposit Account No. 15-0461 |

5936208

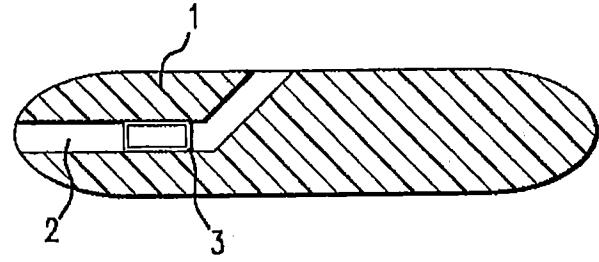


FIG.1

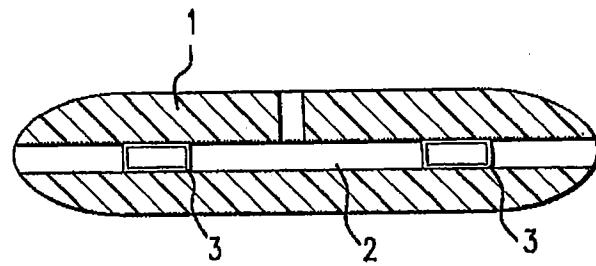


FIG.2

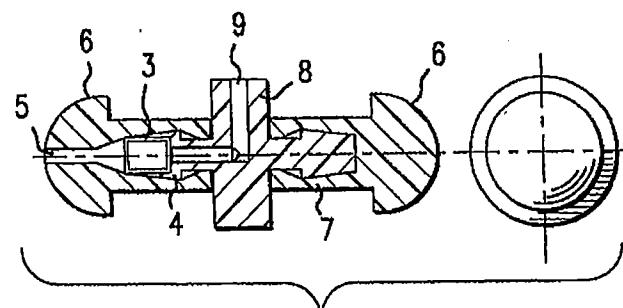


FIG.3

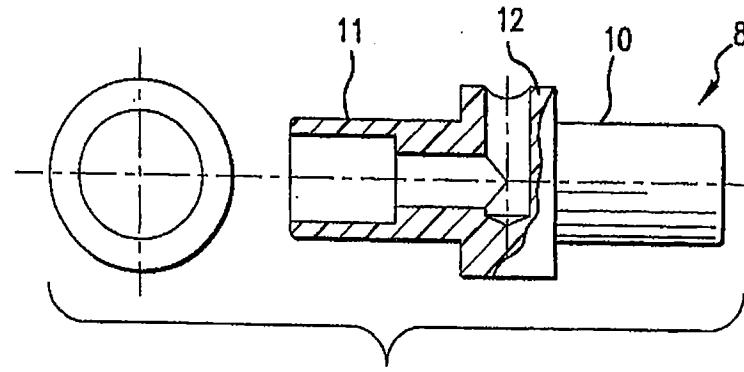


FIG. 4a

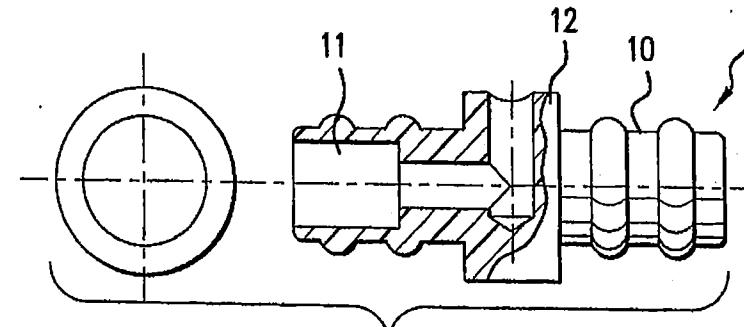


FIG. 4b

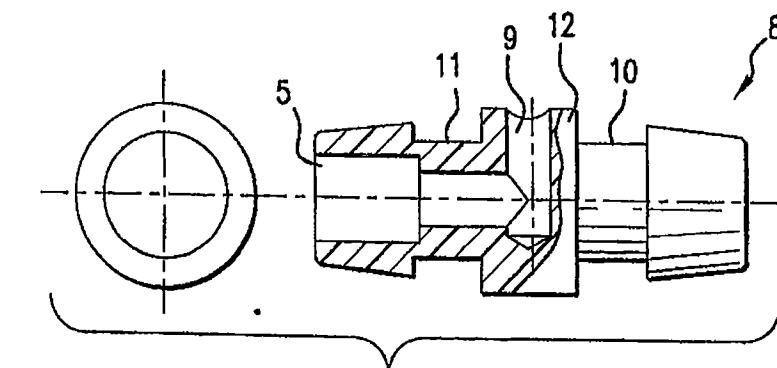


FIG. 4c

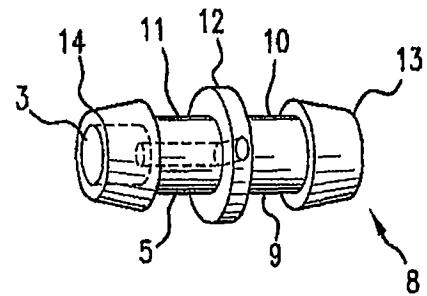


FIG.5

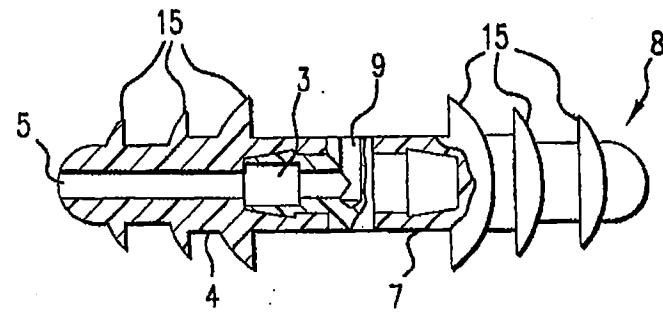


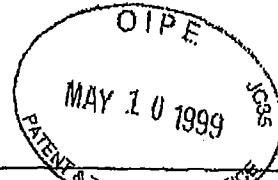
FIG.6

**PART B—ISSUE FEE TRANSMITTAL**

Complete and mail this form, together with:

*KS*

able fees, to: Box ISSUE FEE  
Assistant Commissioner for Interiors  
Washington, D.C. 20231



**MAILING INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence addressee as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark up with any corrections or use Block 1)

1000 LEAVENWORTH  
SUITE 100  
Arlington, VA 22209

10451-051-16

Note: The certificate of mailing below can only be used for domestic mailing of the Issue Fee Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing.

**Certificate of Mailing**

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee addressee above on the date indicated below.

(Depositor's name)

(Signature)

(Date)

| APPLICATION NO.       | FILING DATE | TOTAL CLAIMS | EXAMINER AND GROUP ART UNIT | DATE MAILED |
|-----------------------|-------------|--------------|-----------------------------|-------------|
| 10/17/97              | 01/01/98    | 1            | 7617 02/16/99               |             |
| First Named Applicant | 10/17/97    | 01/01/98     | 7617 02/16/99               | 0 Days      |

TITLE OF INVENTION

| ATTY/B DOCKET NO. | CLASS-SUBCLASS | BATCH NO. | APPLN. TYPE | SMALL ENTITY | FEES DUE       | DATE DUE |
|-------------------|----------------|-----------|-------------|--------------|----------------|----------|
|                   | 181-135-060    | 1314      | UTILITY     | NO           | 100226 \$1,210 | 05/17/99 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.983). Use of PTO form(s) and Customer Number are recommended; but not required.

Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

"Fee Address" indication (or "Fee Address" indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Oliff & Berridge, PLC

2 \_\_\_\_\_

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)  
**PLEASE NOTE:** Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

INSTITUT FRANCO-ALLEMAND DE RECHERCHES DE SAINT-Louis  
(B) RESIDENCE: (CITY & STATE OR COUNTRY)

SAINT-Louis CEDEX, FRANCE

Please check the appropriate assignee category indicated below (will not be printed on the patent)

Individual  corporation or other private group entity  government

4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):

Issue Fee Chk. No. 100226 \$1,210  
 Advance Order - # of Copies \_\_\_\_\_

4b. The following fees or deficiency in these fees should be charged to:

DEPOSIT ACCOUNT NUMBER 15-0461

(ENCLOSE AN EXTRA COPY OF THIS FORM)

Issue Fee  
 Advance Order - # of Copies \_\_\_\_\_

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the Issue Fee to the application identified above.

(Authorized Signature)

Murat Ozgu, Reg. No. 44,275

(Date)

5/10/99

NOTE: The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

**Burden Hour Statement:** This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO: Box Issue Fee, Assistant Commissioner for Patents, Washington D.C. 20231

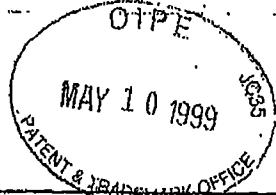
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

100-1311-1

## PART B—ISSUE FEE TRANSMISSION

Complete and mail this form, together with the issue fee, to:

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Assistant Commissioner for Patents  
Washington, D.C. 20231



**MAILING INSTRUCTIONS:** This form should be used for transmitting the ISSUE FEE. Blocks 1 through 4 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)  
OLIFF & BERRIDGE  
P O BOX 19928  
ALEXANDRIA VA 22320

MM51/0216

Note: The certificate of mailing below can only be used for domestic mailings of the Issue Fee Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing.

**Certificate of Mailing:**

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below.

(Depositor's name)

(Signature)

(Date)

| APPLICATION NO.       | FILING DATE | TOTAL CLAIMS              | EXAMINER AND GROUP ART UNIT | DATE MAILED    |
|-----------------------|-------------|---------------------------|-----------------------------|----------------|
| 08/994,015            | 12/18/97    | 015                       | HANG, R                     | 28037 02/16/99 |
| First Named Applicant | HANG, R     | 53 USC 154(b) term ext. = | 0 Days.                     |                |

TITLE OF INVENTION:  
HEARING PROTECTOR AGAINST LOUD NOISES

| ATTY'S DOCKET NO. | CLASS-SUBCLASS | BATCH NO. | APPLN. TYPE | SMALL ENTITY | FEES DUE   | DATE DUE |
|-------------------|----------------|-----------|-------------|--------------|------------|----------|
| 3 WFG4011.26      | 151-135.000    | P14       | UTILITY     | NO           | \$1,210.00 | 02/17/99 |

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.

- Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.  
 "Fee Address" indication (or "Fee Address" indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1. OLIFF & Berridge, PLC  
2. \_\_\_\_\_  
3. \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)  
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

## (A) NAME OF ASSIGNEE

INSTITUT FRANCO-ALLEMAND DE RECHERCHES DE SAINT-LOUIS  
(B) RESIDENCE: (CITY & STATE OR COUNTRY)

SAINT-LOUIS CEDEX, FRANCE

Please check the appropriate assignee category indicated below (will not be printed on the patent)

- Individual  corporation or other private group entity  government

- 4a. The following fees are enclosed (make check payable to Commissioner of Patents and Trademarks):

- Issue Fee Chk. No. 100226 \$1,210  
 Advance Order - # of Copies \_\_\_\_\_

- 4b. The following fees or deficiency in these fees should be charged to:

DEPOSIT ACCOUNT NUMBER 15-0461

(ENCLOSE AN EXTRA COPY OF THIS FORM)

- Issue Fee  
 Advance Order - # of Copies \_\_\_\_\_

The COMMISSIONER OF PATENTS AND TRADEMARKS IS requested to apply the issue fee to the application identified above.

(Authorized Signature)

Murat Ozgu, Reg. No. 44,275 M.Ozgu

(Date)

5/10/99

NOTE: The issue fee will not be accepted from anyone other than the applicant, a registered attorney or agent, or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

**Service Hour Statement:** This form is estimated to take 0.2 hours to complete. Time will vary depending on the needs of the individual case. Any comments on the amount of time required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND FEES AND THIS FORM TO: Box Issue Fee, Assistant Commissioner for Patents, Washington, D.C. 20231.

Patent and Trademark Reduction Act of 1996 (PL 104-106) requires a mandatory fee collection.

# EXHIBIT F

UNITED STATES DISTRICT COURT  
DISTRICT OF MINNESOTA

3M COMPANY and  
3M INNOVATIVE PROPERTIES  
COMPANY,

Plaintiff,

vs.

MOLDEX-METRIC, INC.,

Defendant.

Civil No. 0:12-cv-00611-JNE-FLN

**DEFENDANT MOLDEX-METRIC,  
INC.'S OBJECTIONS AND  
RESPONSES TO PLAINTIFFS' FIRST  
SET OF INTERROGATORIES**

Pursuant to Federal Rule of Civil Procedure 33, defendant Moldex-Metric, Inc. ("Defendant" or "Moldex") hereby responds to plaintiffs 3M Company and 3M Innovative Properties Company's (together, "3M") First Set of Interrogatories as follows:

**GENERAL OBJECTIONS**

Moldex responds to each of 3M's interrogatories subject to the following General Objections. These objections form a part of and are specifically incorporated into each of Moldex's Specific Responses and Objections to 3M's interrogatories, even though they may not be specifically referred to in each and every response to each interrogatory. Failure to specifically refer to any of these General Objections in any specific response should not be construed as a waiver of same.

1. Moldex objects to each interrogatory to the extent that it seeks to elicit information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected against discovery.

2. Moldex objects to each interrogatory to the extent that it does not state with reasonable particularity the information requested.

3. Moldex objects to each interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, not reasonably calculated to lead to the discovery of admissible evidence, or that is otherwise beyond the scope of permissible discovery in this proceeding.

4. Moldex objects to each interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague, and/or ambiguous.

5. Moldex objects to each interrogatory to the extent that it seeks to impose on Moldex obligations greater than or different from those imposed under the Federal Rules of Civil Procedure, or any other applicable law or rule.

6. Moldex objects to each interrogatory to the extent it is a premature contention interrogatory or otherwise purports to require Moldex to identify all facts or evidence with respect to a particular topic or issue. Moldex reserves the right to update, modify, delete, revise and otherwise change each of the responses provided herein as new facts, evidence and analysis become available to Moldex.

7. Moldex objects to each interrogatory to the extent that it purports to require Moldex to list or identify all documents related to a particular topic or issue or to the extent that they purport to require Moldex to perform an unreasonable search for information, as such a request is unduly burdensome and oppressive.

8. Moldex objects to each interrogatory to the extent that it calls for information protected from disclosure by Federal Rule of Evidence 408.

9. Moldex objects to each interrogatory to the extent that it seeks information already within 3M's knowledge or control, or equally or more easily available to it, on the grounds that such interrogatories are unduly burdensome or oppressive.

10. Moldex objects to each interrogatory to the extent that it calls for the disclosure of materials prepared in preparation for trial.

11. Moldex objects to each interrogatory to the extent that it purports to require disclosure of information not within Moldex's possession, custody, or control.

12. Moldex objects to each interrogatory to the extent that it purports to require Moldex to disclose information which Moldex is required to maintain in confidence pursuant to an agreement or understanding with any third party. Moldex will not disclose this information without an appropriate release from any such third party.

13. The following specific responses contain the information reasonably available to Moldex at this time. Moldex reserve their right to amend or supplement these responses as additional discovery and investigations continue, in the event that additional information is disclosed, or the event of error, inadvertent mistake or omission.

14. Moldex's responses to categories of information requested by 3M's interrogatories are not, and shall not be construed as, an admission by Moldex that such information exists.

15. Moldex's response to each interrogatory is hereby made without in any way waiving or intending to waive, but rather, to the contrary, by preserving and intending to preserve:

- (a) All questions as to the competence, relevance, materiality, and admissibility as evidence for any purpose of the information or the subject matter thereof, in any aspect of this or other judicial proceeding, or other administrative proceeding or investigation;
- (b) The right to object on any ground to the use of any such information, or the subject matter thereof, in any aspect of this or other judicial proceeding, or other administrative proceeding or investigation;
- (c) The right to object at any time for any further response to this or any other request for information or production of documents;
- (d) The right to rely on information discovered or generated subsequent to these responses; and
- (e) The right at any time to supplement these responses.

16. Moldex responds to each interrogatory without waiving or intending to waive, but rather preserving and intending to preserve, its right to object to any other discovery including without limitation any other request.

**OBJECTIONS TO DEFINITIONS**

1. Moldex objects to 3M's definition of the terms "Moldex," "Defendant," "you," and "your" to the extent each seeks to impose on Moldex obligations greater than or different from those imposed under the Federal Rules of Civil Procedure, or any other applicable law. Moldex understands "Moldex," "Defendant," "you," and "your" to refer to Moldex-Metric, Inc. and responds accordingly. Moldex also objects to this definition to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague,

and/or ambiguous. Moldex also objects to this definition to the extent that it modifies the interrogatories to seek information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding.

2. Moldex objects to each of the Definitions to the extent that each is overly broad, unduly burdensome, vague and ambiguous, not reasonably calculated to lead to the discovery of admissible evidence, and imposes duties upon Moldex beyond the duties required by the Federal Rules of Civil Procedure, or any other applicable law.

#### **OBJECTIONS TO INSTRUCTIONS**

3. Moldex objects to Instructions 1-4 to the extent that each is overly broad, unduly burdensome, not reasonably calculated to lead to the discovery of admissible evidence, and imposes duties upon Moldex beyond the duties required by the Federal Rules of Civil Procedure, or any other applicable law.

#### **SPECIFIC RESPONSES AND OBJECTIONS**

Moldex hereby incorporates by reference each of its General Objections, Objections to Definitions, and Objections to Instructions into each of its responses to 3M's interrogatories.

##### **INTERROGATORY NO. 1:**

For each of the Accused Products, identify the facts and circumstances under which Moldex designed each product and began offering each product for sale.

RESPONSE TO INTERROGATORY NO. 1:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time, and especially with respect to the terms "circumstances" and "designed."

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein by reference, and without waiving these objections and the grounds therefore, Moldex responds as follows:

Moldex developed each of the accused products in house, and then offered each for sale. Moldex first sold an M Series earmuff in 2002. Moldex first sold BattlePlugs in 2011 to the U.S. government. To the extent this request seeks information related to invalidity, it is premature. The parties have agreed on a series of sequenced pretrial

disclosures in accordance with the pretrial order and Moldex will make its required disclosures on matters such as infringement and validity in accordance with that schedule, and any amendments to that schedule.

Moldex also expects to rely upon information not yet in its own possession (such as an identification from Plaintiff of patent claims asserted and its claim construction positions) and the course of fact and expert discovery in continuing to develop its legal and factual contentions in this case.

INTERROGATORY NO. 2:

Identify all persons who are, or at any time were, involved with, or have knowledge of, the design, development, sale, and/or marketing of the Accused Products (broken down by each Accused Product). For any such person, identify the position(s) held by such person and the subject matter on which such person has knowledge.

RESPONSE TO INTERROGATORY NO. 2:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time, and especially with respect to the terms "involved with," "such matter," and "knowledge."

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein by reference, and without waiving these objections and the grounds therefore, Moldex responds as follows:

For BattlePlugs:

- Crest Turdjian - Director of Engineering - design and production\
- Pat Riordan - VP Government sales - marketing and sales
- James Gallegos - Government Sales & Customer/Tech Services Manager - marketing and sales
- Jeff Birkner - VP Technical Services - input on marketing/approval Process
- Lance Watkins - Marketing Director - marketing
- Kuk Kim - Creative Design Manager - marketing design
- Felipe Rosas - Gardena Plant Manager - development production
- Meiling Hsu - VP Finance - financial data regarding sales
- Bernard Mishkin - VP Special Projects - marketing
- James Hornstein- VP Operations and General Counsel - marketing and sales
- Fred Ryan - retired- marketing and sales

For M Series Muffs

- Fred Ryan - retired - marketing and sales
- Terry Grimsley - Project Engineer - design

- Bernard Mishkin - VP Special Projects - marketing
- Dan Dix- retired Project Engineer - design
- Michael Scholey -retired Director of R&D - design
- Meiling Hsu- VP Finance - financial data re sales
- Mark Magidson- CEO - design conception
- Steve Young - R&D -retired design
- Normal Smith retired- R&D - design

INTERROGATORY NO. 3:

For any counterclaims or affirmative defenses that Moldex raises in connection with 3M's Complaint, state the bases for any such counterclaims or affirmative defenses, identify all facts and documents (including prior art documents) that support or relate to these claims or defenses, and identify all persons with knowledge or information that supports or relates to these claims or defenses.

RESPONSE TO INTERROGATORY NO. 3:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time, and especially with respect to the terms "bases" and "knowledge or information."

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein by reference, and without waiving these objections and the grounds therefore, Moldex responds as follows:

Discovery in this litigation is just beginning and the parties have not yet produced documents or interrogatory responses. In addition, 3M has not produced any infringement contentions nor identified the asserted claims in this litigation. In fact, 3M's counsel has declined multiple invitations from Moldex's counsel to explain its basis for its allegations that the accused products infringe the asserted patents. The parties have also agreed on a series of sequenced pretrial disclosures in accordance with the pretrial order and Moldex will make its required disclosures on matters such as infringement and validity in accordance with that schedule, and any amendments to that schedule. Thus, this interrogatory is premature and Moldex is prevented from providing a complete answer to this interrogatory by 3M's failure to identify its infringement positions.

Moldex also expects to rely upon information not yet in its own possession (such as an identification from Plaintiff of patent claims asserted and its claim construction

positions) and the course of fact and expert discovery in continuing to develop its legal and factual contentions in this case.

INTERROGATORY NO. 4:

Describe in detail when and how Moldex first became aware of the '157 Patent and the '693 Patent, and state what actions Moldex took upon learning of the '157 Patent and the '693 Patent.

RESPONSE TO INTERROGATORY NO. 4:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time, and especially with respect to the term "became aware of."

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein

by reference, and without waiving these objections and the grounds therefore, Moldex provides the following response regarding when it first learned of the asserted patents:

Moldex first learned of the '157 patent upon initiation of this suit by 3M.

Moldex's actions upon learning of the '157 patent include, but are not limited to, the actions taken in connection with this litigation to date. These actions include the filing of Moldex's answer, as well as other litigation activity protected by the attorney client privilege and/or work product doctrine. In addition, Moldex sent a letter to 3M with a sample of Moldex's new earmuff, seeking to know whether 3M believes that Moldex's new earmuff infringes the asserted patent.

Based upon a reasonable search, Moldex believes that it first learned of the '693 patent in or about February of 2008. Moldex continued to design and perfect its BattlePlug thereafter without regard to the '693 Patent as Moldex did and does believe its BattlePlug does not infringe the '693 Patent or any other patent. In fact, the '693 patent is referenced in Moldex's patent covering the BattlePlug.

INTERROGATORY NO. 5:

For each of the Accused Products, provide the sales by unit and dollar volume, revenues, and profits during the period Moldex has sold such Accused Products.

RESPONSE TO INTERROGATORY NO. 5:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated

to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time.

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein by reference, and without waiving these objections and the grounds therefore, Moldex responds as follows:

Moldex will identify the revenue and units sold, in dollars, of the M Series muffs for the past six years and year to date after the Court has entered a mutually agreed upon Protective Order.

Sales of BattlePlugs are irrelevant and unlikely to lead to discoverable or admissible evidence as all sales are either directly or for delivery to the U.S. Government and immune from damages or royalty under 28 U.S.C. § 1498. On that basis, Moldex declines to respond further to this request.

**INTERROGATORY NO. 6:**

Describe in detail any step, plan or attempt by you or other acting on your behalf to design around the '157 Patent or the '693 Patent or to otherwise alter or re-design any Moldex product to avoid infringement or potential infringement of the '157 Patent or the

'693 Patent, and identify the person(s) knowledgeable of and/or involved in such step, plan or attempt, and all documents which refer or relate to such step, plan or attempt.

RESPONSE TO INTERROGATORY NO. 6:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.

Moldex objects to this Interrogatory to the extent that it does not state with reasonable particularity the information requested.

Moldex objects to this Interrogatory to the extent that it is overly broad, unduly burdensome, oppressive, redundant, vague and/or ambiguous, including as to time, and especially with respect to the terms "attempt," "knowledgeable," and "such step, plan or attempt."

Subject to the foregoing specific objections and Moldex's General Objections, Objections to Definitions, and Objections to Instructions, which are incorporated herein by reference, and without waiving these objections and the grounds therefore, Moldex responds as follows:

Based on Moldex's analysis of the asserted patents, Moldex does not believe that the accused products infringe any valid claims of any of the asserted patents and therefore a design-around is irrelevant. Moreover, any discussions on this topic are privileged. In addition, Moldex has sold the earmuffs accused of infringing the '157 patent for approximately a decade while the '157 patent only issued on May 2, 2006.

Prior to learning of the '157 patent, Moldex developed an earmuff which it intends to shortly bring to the market. Moldex sent a letter to 3M with a sample of Moldex's new earmuff which is made of two differently colored sections of the exact same plastic material. 3M recently responded, agreeing that Moldex's new earmuff does not infringe the '157 patent.

INTERROGATORY NO. 7:

Describe in detail all facts and circumstances pertaining to Moldex's assertion in its Answer (Doc. 13) that "the United States Army has approved BattlePlug for use by the military, and it has begun purchasing these products for its soldiers."

RESPONSE TO INTERROGATORY NO. 7:

Moldex objects to this Interrogatory to the extent that it seeks information that is protected from disclosure by the attorney-client privilege and/or the work product doctrine or that is otherwise privileged or protected from or against discovery.

Moldex objects to this Interrogatory to the extent that it seeks information not relevant to any claim or defense asserted in this proceeding, is not reasonably calculated to lead to the discovery of admissible evidence, or is otherwise beyond the scope of permissible discovery in this proceeding, especially to the extent it attempts to shift the burden of proof to Moldex.